PB-240 006

TRANSPORTATION CONTROLS TO REDUCE AUTOMOBILE USE AND IMPROVE AIR QUALITY IN CITIES

THE NEED, THE OPTIONS, AND EFFECTS ON URBAN ACTIVITY

Environmental Protection Agency

November 1974

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1. REPORT NO. EPA-400/11-74-002	2.	PB 240 006
4. TITLE AND SUBTITLE Transportation Controls to Reduce Automobile Use and Improve Air Quality in Cities: the Need, the Options, and Effects on Urban Activity		5. REPORT DATE November 1974 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Joel Horowitz and Steven Kuhrtz		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Office of Air and Waste Management Environmental Protection Agency 401 M. Street, S. W. Washington, D. C. 20460		10. PROGRAM ELEMENT NO. 2RW174 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS		13. TYPE OF REPORT AND PERIOD COVERED Final Report 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

Implementing the national air quality standards in certain metropolitan areas will require reductions in automobile emissions greater than those achievable by new car emissions controls, inspection/maintenance, and retrofit. Accordingly, transportation controls to reduce automobile emissions by reducing automobile use have been developed and are being implemented in the affected areas. The approaches to reducing automobile use most frequently used are transit improvements, carpooling programs, and parking restrictions. Programs that combine all three approaches could reduce automobile emissions by as much as 30 percent through diversion of automobile drivers to transit and carpools. However, because of the cost disadvantages created by the underpricing of automobile use, programs not incorporating parking restrictions or other disincentives to low-occupancy automobile travel are unlikely to achieve emissions reductions greater than 5 to 10 percent. In addition to improving air quality, the successful implementation of transportation controls is likely to result in reduced energy consumption, improved traffic safety, less congestion, reduced need for further highway construction, improved mobility for non-drivers, and -- depending on the characteristics of the transit system -- reduced direct monetary costs of transportation.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
air pollution exhaust emissions urban transportation buses automobiles carpools parking		13/B

18. DISTRIBUTION STATEMENT Release unlimited	19. SECURITY CLASS *(This Report)* none	21. NO. OF PAGES 75
	20. SECURITY CLASS *(This page)* none	22. PRICE $4.25- 2.25

i

EPA Form 2220-1 (9-73)

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U S Department of Commerce
Springfield VA 22151

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EPA-400/11-74-002

Transportation Controls to Reduce Automobile Use and Improve Air Quality in Cities

The Need, The Options, and Effects on Urban Activity

by

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Steven Kuhrtz

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR AND WASTE MANAGEMENT
Washington, D.C.
November 1974

preface

This report has been prepared pursuant to Section 4(b)(2)(A) of the Energy Supply and Environmental Coordination Act of 1974. This section states:

> The Administrator shall conduct a study and shall submit a report to the Committee on Interstate and foreign Commerce of the United States House of Representatives and the Committee on Public Works of the United States Senate not later than three months after date of enactment of this paragraph on the necessity of parking surcharge, management of parking supply, and preferential bus/carpool lane regulations as part of the applicable implementation plans required under this section to achieve and maintain national primary ambient air quality standards. The study shall include an assessment of the economic impact of such regulations, consideration of alternative means of reducing total vehicle miles traveled, and an assessment of the impact of such regulations on other Federal and State programs dealing with energy or transportation. In the course of such study, the Administrator shall consult with other Federal officials including, but not limited to, the Secretary of Transportation, the Federal Energy Administrator, and the Chairman of the Council on Environmental Quality.

acknowledgements

Many people assisted in the preparation of this report, either by preparing draft material or by providing documents describing Federal policies and regulations. The authors thank the following individuals for their invaluable assistance in this respect: Kent Berry, Barbara Brown, David Hanson, William Pedersen, Richard Penna, and Cheryl Wasserman, all of the Environmental Protection Agency; Martin Convisser and Lee Wallerstein of the Department of Transportation, and Elizabeth Bennett and Marvin Manheim of the Massachusetts Institute of Technology. In addition, the authors thank Margaret Lee of the Environmental Protection Agency for her patience in typing several drafts of this report.

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summary

The Clean Air Amendments of 1970 (hereafter referred to as the Act) required the Administrator of the Environmental Protection Agency (EPA) to establish national primary and secondary ambient air quality standards. The primary standards are and must be established so that their attainment and maintenance will protect the public health with an adequate margin of safety. The secondary standards are to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the atmosphere.

The pollutants for which ambient air quality standards have been promulgated include carbon monoxide and oxidants. For each of these pollutants the primary and secondary standards are the same. The automobile is the principal source of carbon monoxide and oxidants in urban areas. This report focuses on programs developed by EPA in accordance with the Act to achieve the air quality standards for these transportation-related air pollutants.

The Act established three principal approaches to achieving the air quality standards. First, EPA is authorized to promulgate and enforce emissions standards for new automobiles. In addition, EPA is authorized to establish emissions standards for trucks and motorcycles. EPA has used this authority to establish increasingly stringent emissions standards for cars and initial standards for trucks. More stringent truck standards as well as motorcycle emissions standards are now under development.

The Act specifically required automobiles manufactured during or after model year 1975 to achieve carbon monoxide and hydrocarbon emissions reductions of 90 percent relative to the 1970 model year. Automobiles manufactured during and after model year 1976 were required to achieve 90 percent reductions in nitrogen oxides emissions relative to the 1971 model year.* Subsequently, the Energy Supply and Environmental Coordination Act of 1974 extended both of these deadlines for two years.

The second emissions control approach established by the Act authorizes EPA to promulgate emissions standards for new stationary emissions sources if it is determined that such sources contribute to the endangerment of public health or welfare. New source performance standards have been promulgated for 12 stationary source categories.

Finally, the Act makes each State initially responsible for developing and enforcing any emissions control regulations and other measures which, together with the automobile emissions standards and new source performance standards, are needed to achieve the ambient air quality standards within the State's jurisdiction. These emissions control regulations are contained in State implementation plans (SIP's). EPA is required to insure that each State develops a SIP that adequately provides for the attainment and maintenance of the ambient air quality standards. Moreover, EPA is required to promulgate SIP's or SIP provisions for States that fail to develop adequate SIP's of their own. The Act requires SIP's to provide for the attainment of the air quality standards by 1975. However, EPA is authorized to extend this deadline to 1977 if: (1) there is a lack of adequate control technology for one or more emissions sources, and (2) all reasonably available control measures have been applied.

The Act specifically envisioned the likelihood that transportation control measures to reduce automobile emissions below the levels achieved by the new car standards would be needed in some SIP's. Although the new car standards achieve substantial reductions in automobile emissions, these reductions, together with reductions of stationary source emissions, are not sufficient to achieve the air quality standards in all parts of the country.

The SIP's were submitted to EPA by the States in February, 1972. It was found that the oxidant air quality standard was exceeded in 54 air quality control regions (AQCR's) and that the carbon monoxide standard was exceeded in 29. In total, 66 AQCR's, representing roughly 60 percent of the nation's population, exceeded one or both of these standards. By 1975 the emissions reductions achieved by the new car standards and stationary-source controls are expected to reduce to 27 the number of AQCR's exceeding the oxidant or carbon monoxide air quality standards. These 27 AQCR's require the application of transportation control measures to achieve the oxidant and carbon monoxide standards. Hence, EPA required the affected States to develop and submit for approval transportation control plans to reduce automobile emissions in the 27 AQCR's.

There are two basic types of transportation control measures: (1) measures that reduce emissions from individual vehicles, and (2) measures that reduce automobile use (e.g., vehicle miles travelled). The first approach includes inspection/maintenance and retrofit. The second includes transit improvements, carpool programs, and disincentives to the use of low-occupancy automobiles. The need for reductions in automobile use is illustrated in Table S-1, which shows the number of AQCR's that would fail to achieve the oxidant and carbon monoxide standards in various years through 1985 if only new car controls, stationary source controls, inspection/maintenance, and retrofit were implemented. As many as 17 AQCR's would fail to achieve the standards in 1977, and as many as 10 would fail in 1985. Clearly, further reductions in automobile emis-

Table S-1

Number of AQCR's Failing to Comply With Oxidant and/or CO Standard in Indicated Year

Calendar Year		
1977	**1980**	**1985**
12-17	8-10	5-10

Ranges reflect uncertainty in degree of stationary source control that will be achieved. Analysis excludes New York City, Denver, Fairbanks. Control strategy consists of stationary source controls, new car controls, inspection/maintenance, and retrofit.

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*Hydrocarbons and nitrogen oxides react chemically in the atmosphere to form oxidants.

sions are needed in many AQCR's to achieve the air quality standards in the foreseeable future. Moreover, in many cases this need will persist indefinetly.

As required by the Act and subsequent court decisions, EPA approved or promulgated transportation control measures during 1973 for the AQCR's requiring transportation controls. When promulgation was necessary, EPA based its selection of measures upon the following factors:

- The emissions and VMT (i.e., vehicle miles of travel) reduction capabilities of alternative combinations of measures.
- The legal defensibility and enforceability of alternative measures.
- Experience obtained through the implementation of measures by State and local authorities.
- The quality of existing or proposed transit service in the affected areas.
- The potential economic and social disruption associated with alternative combinations of measures.

During the development of transportation control plans, it was found that at least 10 heavily polluted regions are unlikely to achieve the transportation-related air quality standards by 1977 without the implementation of extreme traffic restraint measures that would create severe economic and social disruption. To avoid the need for implementing such measures, EPA has submitted to Congress a proposed amendment to the Act that would provide additional flexibility in the deadlines for achieving the transportation-related air quality standards without sacrificing the need to improve air quality as rapidly as possible.

The VMT-reduction measures most frequently occurring in the transportation control plans approved or promulgated by EPA are:

- Transit improvements
- Carpooling programs
- Priority treatment for buses and carpools on streets and freeways (e.g., exclusive bus lanes)
- Parking restrictions

Several of the EPA promulgations also included parking surcharges designed to increase the costs of parking and, thereby, to encourage the use of transit and carpools instead of low-occupancy automobiles. These surcharges were withdrawn in anticipation of the Congressional directive later enacted in the Energy Supply and Environmental Coordination Act of 1974.

The VMT reduction measures included in the transportation control plans are designed to reduce automobile travel and, therefore, emissions by encouraging the use of transit and carpools and discouraging the use of low-occupancy automobiles. The measures achieve these goals by:

- Improving the quality of service provided by transit and carpools, thereby making them more attractive relative to the low-occupancy automobile.
- Restricting or, prior to the withdrawal of parking surcharges, pricing parking facilities.

The purpose of the latter approach is to mitigate the cost disadvantage imposed on transit and carpools by the current substantial underpricing of automobile use in cities. This underpricing, which is particularly severe for work trips, can exceed $2.00 per day.

Evidence derived from empirically-based studies of traveller response to changes in transportation options indicates that programs that combine transit improvements, carpool incentives, and parking restrictions or charges can reduce automobile emissions by as much as 30 percent. However, because of the cost disadvantages created by the underpricing of auto use, programs that do not incorporate parking restrictions, surcharges, or other disincentives to low-occupancy automobile travel are unlikely to achieve emissions reductions greater than 5 to 10 percent. Indeed, the most successful carpooling programs to date have developed as a result of the unavailability of parking facilities.

Reductions in automobile use resulting from the successful implementation of transportation controls will alleviate a wide variety of urban transportation problems in addition to improving air quality. For example:

- A 20 percent reduction in automobile travel achieved by diverting commuters to transit could reduce energy consumption for urban passenger transportation by 10 percent or more.
- Transit vehicles have lower accident costs and fewer fatalities per passenger mile travelled than automobiles. The diversion of travellers from cars to transit will reduce both traffic fatalities and accident costs.
- The use of transit and carpools can significantly reduce both traffic congestion and the need for further highway construction. For example, 3 additional freeway lanes would be needed to carry present Shirley Highway bus riders in cars at the existing automobile service level.
- Reductions in automobile use achieved through the diversion of automobile drivers to transit and carpools could reduce the total direct monetary costs of urban commuter transportation by as much as $100 per commuter per year.
- Improved transit service associated with transportation controls will increase the mobility of persons who do not have access to automobiles.
- The revenues derived from parking surcharges can contribute significantly to defraying the costs of transit improvements while alleviating the effects of the underpricing of automobile travel. For example, a $2.00 daily parking surcharge that affected only 10 percent of automobile commuter trips in the Washington, D. C. area would collect revenues equal to nearly twice the FY 1974 operating deficit of the Washington area transit system.

Not all of the effects of reductions in automobile use are likely to be beneficial. For example, increased use of transit instead of cars is likely to increase travel times, especially for commuters.

Parking restrictions or surcharges can seriously restrict mobility if adequate transit or carpool service is not provided. However, there is evidence that commercial areas do not necessarily require automobile access to be successful if alternative means of access are available. Moreover, there is much evidence indicating that transit and carpools can provide satisfactory access to work locations when parking is restricted. For example, in 1972 a strike of parking lot employees in Pittsburgh, Pennsylvania caused the closing of 80 percent of the parking spaces in downtown Pittsburgh. During the strike a number of improvements and additions to transit service were made. Most commuters switched to transit. Absenteeism among employees remained normal. Moreover, the parking spaces that were available during the strike were not fully utilized.

Many of the policies and programs of the Department of Transportation are supportive of certain measures contained in the transportation control plans. Some examples of this support include:

- DOT is prepared to provide up to $200 million in FY 1974-75 for mass transit capital grants to implement transportation control strategies.
- DOT now requires that transportation plans and programs developed through the urban transportation planning process be consistent with approved State implementation plans to achieve the ambient air quality standards.
- DOT encourages States to give specific consideration to low cost transportation improvements (e.g., bus priority treatment, carpool programs, parking restrictions) prior to a decision to implement major capital investment projects (e.g., rail transit, new freeways). Moreover, DOT is now developing guidelines for the preparation of short range transportation improvement programs directed toward the achievement of urban areas' short-range transportation objectives. These short-range programs are expected to emphasize the implementation of low cost transportation options directed toward alleviating current urban transportation problems.
- The Department has strongly endorsed the principal of removing subsidies to the automobile and has indicated that this could mean parking taxes, traffic restraints, or other related measures.

The close parallelism between certain aspects of the urban transportation programs of EPA and DOT will continue to provide opportunities for mutual assistance and cooperation between the two agencies. Each agency's program can benefit in certain respects from that of the other. Possible areas for future cooperation include:

- Increasing the responsibilities of regional transportation agencies for making decisions about transportation controls.
- Encouraging States and localities to experiment with transportation control measures and to monitor the results.

For its part, EPA will continue to work toward the attainment of the health-related (primary) air quality standards as rapidly as possible without creating serious economic and social disruption. EPA's responsibility in this process is to help identify transportation control options and to assist communities in formulating effective transportation control strategies. EPA also has a statutory responsibility to assure that locally formulated plans will achieve the prescribed improvements in air quality and, if the localities default in their responsibilities, to promulgate and enforce its own plans. In fulfilling its responsibilities, EPA will work both with DOT and the affected communities to enable these communities to select transportation control approaches that are consistent with achieving the air quality standards without sacrificing other important social objectives.

chapter 1 - the need for transportation controls

1. Background

The advent of expansive urbanization and industrial development following World War II has brought about a rapid deterioration of the nation's urban air quality. Beginning with the Clean Air Act of 1963 (Ref. 1) numerous attempts have been made to provide Federal legislation which would curtail this trend. With the passage of the Clean Air Amendments of 1970, (Ref. 2) the Congress has provided the means and authority to achieve an extensive and rapid improvement in urban air quality.

The Administrator of the Environmental Protection Agency is required to establish national primary and secondary ambient air quality standards, based on air quality criteria which must "accurately reflect the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare which may be expected from the presence of such pollutant in the ambient air, in varying quantities." (Ref. 3). As prescribed in the Act, the primary standards are ambient air quality standards the attainment and maintenance of which, allowing an adequate margin of safety, are necessary to protect the public health. National secondary ambient air quality standards must specify a level of air quality which is requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air.

Air quality criteria have been published for sulfur oxides (SO_x), particulate matter, photochemical oxidants, carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (NO_x) (Ref. 4). In accordance with the requirements of the Act, the ambient air quality standards for these pollutants were promulgated April 30, 1971 (Ref. 5). The standards for hydrocarbon concentrations are intended to be used as a guide for determining the degree of emission control necessary to comply with the standard for photochemical oxidants.

Table 1

National Primary and Secondary Ambient Air Quality Standards

Pollutant	Air Quality[a] Standards	Averaging Time
Hydrocarbons	0.24 ppm	3 hr. average concentration
Carbon Monoxide	9 ppm	8 hr. average concentration
	35 ppm	1 hr. average concentration
Nitrogen Dioxide	0.05 ppm	Annual average concentration
Photochemical Oxidant	0.08 ppm	1 hr. average concentration

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[a] Primary and Secondary standards for these four pollutants are identical. Standards are not to be exceeded more than once per year.

Source: Reference 5

Oxidants are not directly emitted into the atmosphere, but are a product of atmospheric reactions between nitrogen oxides and reactive hydrocarbons. Further discussion in this report will be limited to the four transportation related (i.e., mobil source) pollutants: carbon monoxide, hydrocarbons, nitrogen oxides, and photochemical oxidants. The national ambient air quality standards for these pollutants are listed in Table 1.

The Congress directed the establishment of three programs for attaining the ambient air quality standards. First, the Administrator of the EPA is empowered to promulgate and enforce emission standards for new motor vehicles. This has been done on an increasingly stringent basis since the 1968 model year. The 1970 Clean Air Amendments specifically mandated regulations requiring that light duty vehicles manufactured during or after the 1975 model year achieve a reduction of at least 90 percent from emissions of carbon monoxide and hydrocarbons allowed for 1970 model year vehicles. Also light duty vehicles manufactured during or after the 1976 model year were required to achieve a 90 percent reduction of nitrogen oxide emissions as measured from 1971 model year vehicles. (Ref. 6). During the interim, the Administrator had the authority to set standards based on the availability of existing technology. Recent amendments to the 1970 legislation (Ref. 7) have extended the deadline for compliance with these standards by two years.* Table 2 shows the exhaust emission levels of uncontrolled cars and the Federal emission standards for 1968 and later model years.

Table 2

Nationwide Federal Emission Control Requirements for Light Duty Vehicles

	Exhaust Emissions[a] (grams/mile)		
Model Year	HC	CO	NO_x
Pre-1968	(8.8)	(87)	(3.6)
1968	6.3	52	NR
1969	6.3	52	NR
1970	4.1	34	NR
1971	4.1	34	(4.0)
1972	3.0	28	NR
1973	3.0	28	3.1
1974	3.0	28	3.1
1975	1.5	15	3.1
1976	1.5	15	3.1
1977	0.41	3.4	2.0
1978	0.41	3.4	0.4

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[a] Numbers shown in parentheses are not Federal emission standards but emissions as measured by the 1975 Federal Test Procedure. The numbers are shown to demonstrate relative emission levels. All standards prior to 1975 have been converted to reflect emissions as measured by the 1975 Federal Test Procedure.

NR - no requirement.

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*Prior to the enactment of this legislation, the Administrator had exercised his statutory authority to defer the 1975/76 emissions standards by one year.

The Administrator is also required to develop emission standards for new stationary sources if it is determined that such sources contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare. (Ref. 8). Table 3 shows the categories and pollutants for which New Source Performance Standards have been promulgated to date.

The Congress recognized that the aggregate level of air pollution is caused by a diversity of source categories; the relative contribution of these sources may vary significantly among the States and regions within the nation. Accordingly, responsibility is placed with the individual State for planning and enforcing the emissions limits and other measures which, together with EPA's new source performance standards and auto emissions standards, are necessary to achieve air quality levels consistent with the national ambient air quality standards. The Environmental Protection Agency is required to ensure that each State develops a plan which adequately provides for the implementation, maintenance and enforcement of these standards.

Table 3

Federal New Source Performance Standards

	Emissions				
Source Category	**SO_x**	**Part.**	**HC**	**CO**	**NO_x**
Steam Generators	X	X			X
Municipal Incinerators		X			
Portland Cement Plants		X			
Nitric Acid Plants					X
Sulfuric Acid Plants	X				
Asphalt Concrete Plants		X			
Petroleum Refineries	X	X		X	
Storage Vessels			X		
Secondary Lead Smelters		X			
Brass or Bronze Ingot Plants		X			
Iron and Steel Plants		X			
Sewage Treatment Plants		X			

Among other requirements, these State implementation plans must provide for attainment of the primary standards no later than June 1975; provide for "emission limitations, schedules, and timetables for compliance with such limitations, and such other measures as may be necessary to insure attainment and maintenance of [primary or secondary ambient air quality standards] , including but not limited to, land-use and transportation controls" (Ref. 9); and provide "to the extent necessary and practicable, for periodic inspection and testing of motor vehicles to enforce compliance with applicable emission standards." (Ref. 10). In the event that a State fails to prepare an acceptable plan, the EPA is required to promulgate a plan or portion of a plan which satisfies all the requirements specified in the Act.

The Act allows the Administrator to extend the deadline for compliance with the primary standard for any pollutant if (a) there is a lack of adequate technology for the necessary control of emissions from one or more sources of this pollutant, and (b) all alternative control strategies for reducing emissions of this pollutant have been considered. The maximum extension allowable under these conditions is two years. Ultimately, therefore, all States must comply with the primary ambient air quality standards by 1977.

The State Implementation Plan provisions allow for the flexibility necessary to counter the variety of air pollution problems which must be addressed throughout the nation. However, within this broad framework, the Congress set forth specific guidance concerning the types of control strategies that would require primary consideration. Of particular concern was the necessity of developing transportation emission control policies to ensure that the degree of air pollution caused by motor vehicles would be reduced to levels compatible with the needs of each region. The Federal emission standards for light duty vehicles will go a long way towards reducing the role of the automobile as a major source of urban air pollution; however, this program by itself is not sufficient to achieve the reduction in automobile emissions needed to meet the ambient air quality standards in all regions. Accordingly, provisions were included in the Clean Air Act for the development of emission control policies to be implemented at the State and regional level to reduce emissions from in-use vehicles and, if necessary, to reduce vehicle use.

The Senate Committee report (Ref. 11) on the 1970 legislation discusses the implications which might be expected for urban transportation systems. The report expressed the realization that in some cases the construction of highways and freeways might have to take second place to the construction or expansion of public transportation systems. Furthermore, the central city use of motor vehicles might have to be restricted. Indeed, the report states that "as much as 75 percent of the traffic may have to be restricted in certain large metropolitan regions if health standards are to be achieved within the time required by this bill [1970 Clean Air Act] ." (Ref. 12).

2. Air Quality Considerations

The initial State Implementation Plans were submitted to the EPA in February 1972, and supplemental plans outlining specific emissions control strategies for transportation sources (Transportation Control Plans) were submitted approximately twelve months thereafter. The air quality data supplied with these plans confirm that the standards for transportation related pollutants have been exceeded in many of the nation's major urban areas. Currently, among the 247 Air Quality Control Regions (AQCR's), 54 exceed the photochemical oxidant standard, 29 exceed the carbon monoxide standard, and 4 exceed the standard for nitrogen dioxide. A total of 66 AQCR's, which represent approximately 60% of the nation's population, are exceeding the air quality standard for one or more of these pollutants. The regions which are currently exceeding the standards for CO and oxidant are listed in Table 4.

The implementation of Federal emission standards for new motor vehicles alone provides substantial reductions in the aggregate emission levels of HC, CO, and NO_x. Projected reductions achieved through the Federal motor vehicle emission control program (FMVECP), in addition to stationary source controls, currently are expected to reduce to 27 the number of AQCR's exceeding one or more of the ambient standards by the statutory deadline in 1975. These 27 regions are listed in Table 5 together with the ambient concentrations for carbon monoxide and photochemical oxidants measured through 1972.

The Federal motor vehicle emission control program will not become fully effective until sometime after 1985, when virtually all cars in the vehicle population are expected to comply with the statutory standards set forth in the Clean Air Act. Table 6 indicates the effect this program will have on air quality between 1977 and 1985. Stationary source controls are also included in these projections. By 1985, there remain about ten urban areas which will fail to comply with the national air quality standards for both oxidant and carbon monoxide.

Clearly, if full compliance with the Clean Air Act is to be achieved, there is a need for further control of emissions from transportation sources to supplement the emissions standards for new motor vehicles. The techniques available for reducing emissions from vehicles in use can be classified within two general categories:

- Measures that reduce the emission levels of individual vehicles, i.e., emissions per vehicle mile of travel
- Measures that reduce total automobile use (e.g., vehicle miles travelled).

The first approach includes the application of retrofit control systems or devices which reduce emissions from vehicles already in use, and the inspection of in-use vehicles to ensure that adequate maintenance is being performed to attain optimum emission control.* The second approach includes efforts to encourage more extensive use of public transportation systems and carpools.

It is important to recognize that the strategies designed to achieve automobile use reductions are remarkably consistent with other objectives directed toward improving the quality of life in contemporary urban environments. The development of a well planned roadway and transport system designed for the efficient movement of people and goods will reduce traffic congestion, urban noise levels, and the consumption of

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*Average carbon monoxide and hydrocarbon emissions per vehicle mile travelled (VMT) also can be reduced through traffic flow improvements that smooth the flow of traffic and increase average speeds. However, traffic flow improvements may induce increases in traffic volumes and VMT that negate the beneficial effects of reduced emissions per VMT. Consequently, EPA has not encouraged the use of traffic flow improvements in transportation control plans.

Table 4

AQCR's Exceeding CO and Oxidant Air Quality Standard

AQCR	CO	Oxidant
Albuquerque	X	X
Atlanta	X	
Atlantic City	X	
Austin		X
Baltimore	X	X
Beaumont		X
Birmingham	X	X
Boston	X	X
Buffalo	X	X
Charleston, W. Va.	X	
Charlotte		X
Chicago	X	X
Cincinnati		X
Cleveland	X	X
Columbus		X
Corpus Christi		X
Dallas		X
Dayton		X
Denver	X	X
Des Moines		X
El Paso	X	X
Fairbanks	X	
Honolulu	X	
Houston		X
Indianapolis	X	X
Indio		X
Jacksonville	X	X
Kansas City	X	X
Las Vegas	X	X
Los Angeles	X	X
Louisville	X	X
Memphis		X
Miami		X
Milwaukee		X
Minneapolis	X	
Mobile	X	
Monterey		X
Nashville	X	X
National Capital	X	X
New York	X	X
Norfolk		X
Oklahoma City	X	X
Omaha	X	
Paducah	X	
Philadelphia	X	X
Phoenix	X	X
Pittsburgh	X	X
Portland, Oregon	X	X
Providence	X	
Richmond, Va.		X
Rochester, N. Y.		X
Sacramento	X	X
St. Louis	X	X
Salt Lake City	X	X
San Antonio		X
San Diego	X	X
San Francisco	X	X
San Joaquin	X	X
Seattle	X	X
Spokane	X	
Springfield, Mass.	X	X
Syracuse	X	X
Tampa		X
Toledo		X
Tulsa		X
Witchita		X

Table 5

1971-1972 Air Quality Levels in Regions Projected to Exceed Primary Ambient Air Quality Standards in 1975

Carbon Monoxide - 8 Hour Average (ppm)

10-15

Indianapolis
Minneapolis-St. Paul

16-20

San Diego
San Francisco
San Joaquin
National Capital
Seattle
Spokane
Chicago

21-24

Sacramento
Baltimore
Boston
Springfield
Portland
Pittsburgh
Salt Lake City

25-35

Fairbanks
Phoenix-Tucson
Denver
Philadelphia

36-42

Los Angeles
New York City

Oxidant - 1 Hour Average (ppm)

.10-.15

Phoenix-Tucson
Philadelphia
Pittsburgh
Dallas-Ft. Worth
San Antonio
Indianapolis
Rochester
Cincinnati
Portland
Seattle
Springfield

.16-.20

Denver
National Capital
New York City

.21-.30

Sacramento
San Joaquin
Baltimore
Boston

.31-.40

San Diego
San Francisco
Houston-Galveston

Greater than .40

Los Angeles

Table 6

Number of Cities Failing to Comply With National Standard for Oxidant and/or CO in Indicated Year[a]

Calendar Year		
1977	1980	1985
21-24	12-14	9-10

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[a] Emission projections assume the implementation of the Federal motor vehicle emission control program and stationary source control but no transportation controls.

Ranges reflect uncertainty in the degree of stationary source control that will be achieved. Analysis excludes New York City, Denver, Fairbanks.

Air quality projections are based on linear rollback for carbon monoxide and on Ref. 13 for oxidant.

valuable land resources for urban highway systems, in addition to improving air quality. Moreover, with normal load factors, the energy efficiency of passenger buses and rail transit compared to the automobile is well recognized. Any reduction of automobile usage by encouraging more extensive use of public transit systems is highly consistent with efforts to conserve the nation's energy sources.

These latter strategies, however, have generated the most controversy surrounding the State Transportation Control Plans. Accordingly, this report has been prepared to explain the measures and programs that have been developed, as required by the Clean Air Amendments, to reduce automobile emissions through the reduction of automobile use. Chapter 2 discusses the need for auto use reduction measures and identifies the magnitude of the reductions for those cities in which they are needed. Chapter 3 discusses the costs and the potential effectiveness of these measures. Chapter 4 outlines the regulatory framework which has been developed to implement the auto use reduction programs. Chapter 5 presents the social and economic effects of these programs. Chapter 6 discusses the relationship between the transportation programs developed to improve air quality and other aspects of transportation planning at the Federal and State level.

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chapter 2 - the need for automobile use reductions

1. Introduction

Chapter 1 discussed the projected effect of the Federal new vehicle emission standards and stationary source controls. Having controlled the emissions from stationary sources and new vehicles to the extent possible, those States containing Air Quality Control Regions still projected to exceed the air quality standards must implement further controls for transportation sources to meet the requirements of the Clean Air Act. Even if the deadline for compliance with the ambient air quality standards is extended to 1985, approximately ten regions would still fail to comply with the standards for both carbon monoxide and photochemical oxidant. Indeed, some of these regions are so severely polluted that they will be unable to achieve the standards at any time in the foreseeable future solely by relying on the new car emission control program and stationary source controls.

Growth of both the vehicle population and vehicle use, deterioration of emission control systems on vehicles in use, and the slow turnover of the vehicle population greatly reduce the impact of the motor vehicle standards within the time period mandated for the attainment of the air quality standards. Figures 1 and 2 display the projected HC and CO emission levels of the light duty vehicle population as a function of time. Relative to 1972, automotive emissions will be reduced only about 25 percent in 1975 and about 45 percent in 1977. Furthermore, the historical growth of the vehicle population and the increasing trend in annual mileage per vehicle lead to a projected increase in automotive emissions sometime after 1985.

The control of emissions from automobiles is essential to ensure full compliance with the requirements of the Clean Air Act because these vehicles comprise the primary source of HC and CO emissions in urban areas. Table 7 shows the general range of relative contributions of urban emissions sources. The data clearly indicate the importance of automotive emission controls.

2. Transportation Emission Control Options

The design of transportation emission control strategies relies upon two general approaches: the reduction of emission levels of individual vehicles in use, and the reduction of the total vehicle miles of travel (VMT). The remainder of Chapter 2 presents a discussion of the costs and effectiveness of in-use vehicle emission control measures, namely, inspection/maintenance (I/M) and retrofit controls. Also included is a discussion of service station emission controls designed to reduce hydrocarbon emissions attributed to gasoline vapor loss during the marketing process. Finally, the magnitude of the VMT reductions for those cities in which they are needed will be considered.

Vehicle miles of travel can be reduced through the implementation of traffic controls, carpooling incentives, the improvement and expansion of public transportation, and direct disincentives to low occupancy automobile use, including parking and auto-user charges. Discussion of the possible costs and potential effectiveness of these programs is presented in Chapter 3.

a. Inspection/Maintenance

Inspection/maintenance programs aim at reducing emissions from in-use vehicles by ensuring that the emission levels of those vehicles are not permitted to deteriorate due to inadequate or improper maintenance. Inspection/maintenance programs can accomplish emission reductions only to the extent that voluntary maintenance is inadequate in maintaining the vehicles in good condition.

All inspection/maintenance approaches include two phases: an inspection phase used to screen the vehicle population to determine which vehicles should be required to receive maintenance; and a maintenance phase, in which appropriate corrective maintenance is performed on the selected vehicles.

Recent studies (Ref. 1) have demonstrated that significant reductions in light duty vehicle emissions can be achieved through mandatory I/M programs. The effectiveness of a program depends primarily upon the fraction of the vehicle population induced to receive corrective maintenance, and to some extent, upon the type of inspection test used. A program of inspecting idle [illegible] exhaust emissions is estimated to result in [illegible] 1 percent for HC and 10 percent for CO if one-half the vehicle population fails the initial inspection and receives corrective maintenance. An initial failure rate of 10 percent would provide reductions of 6 percent for HC and 3 percent for CO. The inspection of exhaust emissions while imposing a load on the engine (a loaded mode test) should provide a 15 percent HC reduction and a 12 percent CO reduction at a 50 percent initial failure rate; and an 8 percent HC reduction and a 4 percent CO reduction at a 10 percent initial failure rate. These figures are representative of an annual inspection program. More frequent inspection and maintenance would be expected to provide larger average emissions reductions. I/M programs are not expected to have a significant effect on NO_x emissions from automobiles prior to the 1973 model year.

The estimated investment cost for an annual emissions inspection program using State operated lanes is less than $3.50* per vehicle for a loaded mode test and less than $2.00 per vehicle for an idle mode test. The annual operating cost is approximately $2.50 per vehicle for either test procedure. Maintenance costs observed in fleet studies of various I/M programs have been found to be in the range of $20 to $30 (Ref. 1) for those vehicles failing the inspection test. Accounting for the current level of voluntary maintenance and assuming a 30 percent failure rate, the average net incremental annual cost of inspection and maintenance is about $4 per vehicle (Ref. 1). The higher frequency of maintenance induced by an inspection program is expected to reduce fuel consumption by approximately 2 percent (Ref. 5). At current gasoline prices, this represents an annual savings of $10 per vehicle+.

b. Retrofit Devices

Retrofit approaches go beyond the attempt made by inspection/maintenance programs to keep in-use vehicles at minimum emission levels consistent with their

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*All costs are in 1974 dollars.

+Assuming 12,000 miles per year, 13 miles per gallon, and $.58 per gallon.

Figure 1

AUTOMOBILE HC EMISSIONS

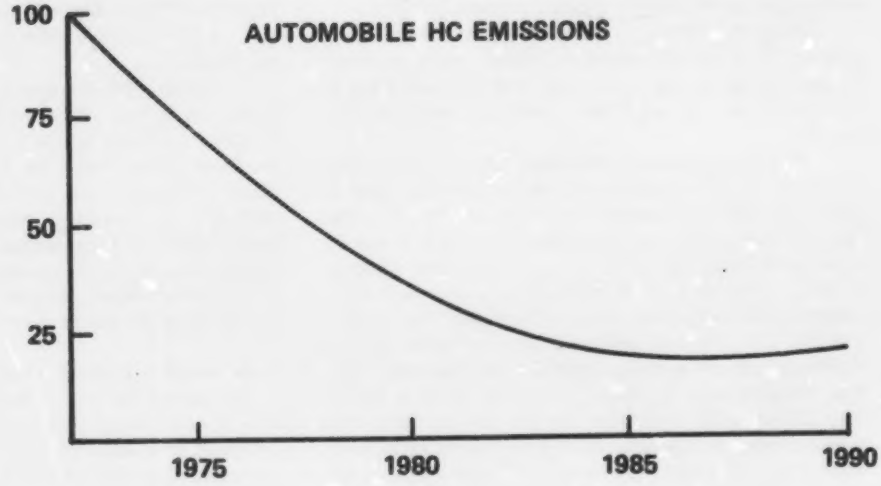

Figure 2

AUTOMOBILE CO EMISSIONS

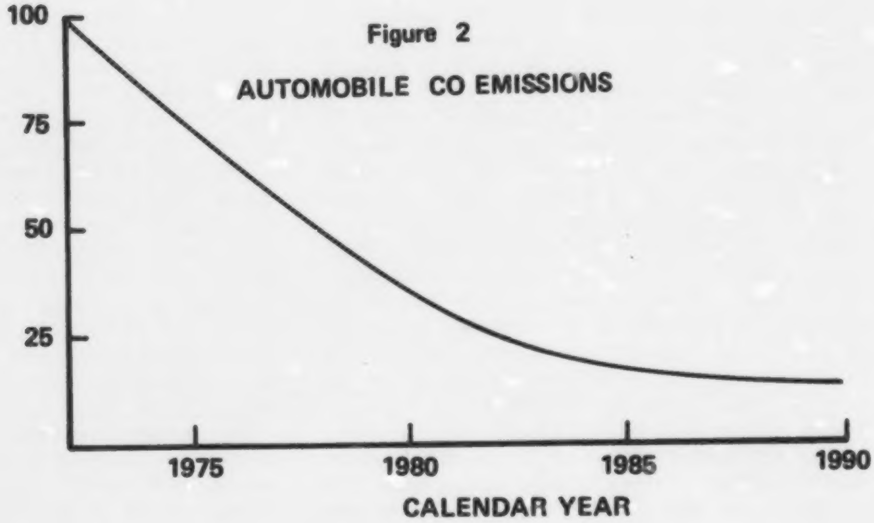

Table 7

Emission Sources in Urban Areas - 1971

	Pollutant Percent of Total[a]		
Emission Source Category	**HC**	**CO**	**NO_x**
Automobiles	50-65	77-87	40-50
Trucks, Buses, Motorcycles	5-10	8-10	8-13
Stationary Sources	25-45	3-15	37-52

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[a] Based on emissions inventories contained in State Implementation Plans.

age and original design. The objective of a retrofit approach is to reduce the emission levels of an in-use vehicle below its "well-maintained" levels through the addition of a device or system and/or a modification or adjustment after its initial manufacture. Three retrofit approaches are currently under consideration for widespread implementation:

Vacuum Spark Advance Disconnect. Two basic engine modifications employed by motor vehicle manufacturers in meeting Federal exhaust emission standards have been the leaning of air/fuel ratios and the modification of ignition (spark) timing. The modification of these parameters in pre-controlled (pre-1968) vehicles will reduce CO emissions by 9 percent, HC emissions by 25 percent, and NO_x emissions by 23 percent. (Ref. 1). The installed cost of a vacuum spark advance disconnect system is approximately $20. The estimated maintenance cost is $5 per year (Ref. 5). Fuel consumption can be expected to increase by about 2 percent.

Because 1968 and later model year vehicles have utilized these modifications to some extent to meet Federal emission standards, this retrofit technique is considered to be applicable only to pre-controlled vehicles.

Air Bleed to Intake Manifold. Much of the effort in the design of emission control systems has concentrated on various means to introduce excess air in the fuel mixture prior to combustion. The effect is one of reducing HC and CO levels with possibly some increase of NO_x emissions. Devices using this approach have achieved CO reductions of approximately 50 percent and HC reductions of about 23 percent. (Ref. 1). No significant effect on NO_x emissions has been observed. The installed cost of typical air bleed devices ranges from $20 to $60, depending on the complexity of the vehicle's induction system. The estimated annual maintenance cost is $7. Application of the air bleed system has been observed to decrease fuel consumption by up to 4 percent.

This technique is applicable to some extent to all light duty vehicles through the 1971 model year; however, because of the relatively lean air/fuel ratios on most controlled vehicles, the technique is primarily applicable to pre-1968 vehicles.

Catalytic Converter. This approach involves the installation of an oxidation catalyst in the vehicle's exhaust system. Catalytic converter systems reduce both CO emissions and HC emissions by about 50 percent. (Ref. 1). No significant effect on NO_x emissions is expected. The installed cost of catalyst retrofit systems ranges from $55 to $200. (Ref. 5, 6). The installed cost for a specific model automobile will depend on the engine size and whether or not the vehicle is equipped with a factory installed air injection system. The estimated annual maintenance cost is $12.50 per vehicle.

To maintain the full effectiveness of a catalyst retrofit system, lead-free fuel must be used. However, not all vehicles can operate on commercially available lead-free gasoline without excessive engine wear. Currently, it is estimated that catalyst retrofit systems would be applicable for use on about 75 percent of 1971-74 model year vehicles and about 20 percent of 1968-70 model year vehicles. However, considerably more work is needed to identify the specific makes and models that could accept catalytic retrofits. Moreover, a number of technological issues, principally associated with catalyst durability, remain to be resolved. Retrofit for 1975 and later automobiles is not under consideration because most of these cars will be factory-equipped with catalyst emission control systems.

c. Service Station Vapor Controls.

Although the hydrocarbon vapors emitted to the air from service stations cannot be considered motor vehicle emissions, the relationship between these vapor losses and vehicle use is so direct that their control can be legitimately included within the category of transportation controls.

The average service station sells approximately 25,000 gallons of gasoline per month and in the process is estimated to emit nearly 400 pounds of hydrocarbon vapor. By 1975, uncontrolled vapor losses of this magnitude will make the service station as important a source of HC emissions as some of the vehicles it serves. Translated into grams per mile, the HC emissions from the service station exceed the 1977 new car HC standards.

Service station vapor losses result primarily from tank truck unloading and vehicle fueling. Vapors emitted in these processes account for over 90 percent of the total vapor loss. Vapor control techniques are presently being developed and implemented which show the potential for reducing these emissions by over 90 percent (Ref. 2) (a reduction of over 80 percent in total service station vapor losses). The annualized cost of service station vapor controls is estimated to be approximately $2.60 per car per year.

3. Automotive Emissions Reductions.

The reductions in total automotive emissions that can be achieved through inspection/maintenance and retrofit can be illustrated by considering three possible emission control strategies for in-use vehicles. Strategy 1 consists of inspection/maintenance using a loaded mode test for all model year vehicles. Strategy 2 requires inspection/maintenance for all cars and air bleed retrofit for all 1971 and earlier model years. Strategy 3 requires inspection/maintenance for all cars, air bleed retrofit for all 1971 and earlier model years, and catalyst retrofit for 1972 through 1974 model years. It is assumed that the catalyst retrofit will only be required for 75 percent of the 1972-1974 model year group.

The impact of I/M programs or retrofit programs on motor vehicle emissions levels will depend on many factors which may vary significantly between regions. Most important among these factors are the age distribution of the vehicle population, the annual mileage accumulation of different age groups, and the turnover rate of the vehicle population. The effectiveness calculations for the three emission control strategies are based on a hypothetical vehicle population which represents average nationwide data.

The emissions reductions achieved by these three strategies are displayed in Table 8 for the period 1977 through 1990. Initially, Strategy 3, which includes the catalyst retrofit, is the most effective. The air bleed retrofit program is more than twice as effective as inspection/maintenance alone (Strategy 1). However, as the older cars which are subject to the retrofit requirements are retired from the vehicle population, the effectiveness of both retrofit programs decreases rapidly.

Table 8

Automobile Emissions Reductions Achieved by In-Use Vehicle Emission Controls

	Emissions Reduction (%)							
	1977		1980		1985		1990	
	HC	CO	HC	CO	HC	CO	HC	CO
Strategy 1	12	12	12	12	12	12	11	12
Strategy 2	20	37	17	26	12	12	11	12
Strategy 3	28	48	27	41	16	21	11	12

Strategy 1: Inspection/maintenance
Strategy 2: Inspection/maintenance + Air Bleed
Strategy 3: Inspection/maintenance + Air Bleed + Catalyst
The costs of these emissions controls are discussed in the text.

By 1985, Strategy 1 and Strategy 2 are equally effective, and 75 percent of the reduction achieved by Strategy 3 is attributed to inspection/maintenance. Accordingly, the time period during which emission reductions are required must play a key role in determining the usefulness of a retrofit program. In general, retrofit is a short term approach to reducing emissions from in-use vehicles.

4. Effects on Air Quality

The potential air quality benefits of I/M, retrofit, and vapor recovery can be demonstrated by considering the number of additional cities which are able to comply with the ambient standards as a result of implementing these measures. Table 9 displays the number of cities failing to comply with the standards through 1985 assuming the I/M, retrofit, and vapor recovery control strategy is fully implemented by 1977. In comparison, the number of cities failing to comply without these controls is also shown. The effectiveness of the controls is greatest during the first few years when the largest number of older cars, subject to the retrofit requirements, are still on the road. In 1977, the implementation of the I/M, retrofit, and vapor recovery programs is expected to enable about ten additional regions to comply with the air quality standards. By 1985, roughly two additional regions would be able to comply; however, at least 5 regions would still be above the standards.

5. Auto Use Reductions

Both cost and technological constraints limit the extent to which the emission level of in-use vehicles can be reduced. The maximum feasible reductions are assumed to be achieved by the in-use vehicle control strategy displayed in Table 9. To the extent that further control of motor vehicle emissions is necessary, reductions in automobile use are required.

In any particular air quality control region, the adequacy of transportation emission control strategies for achieving the national ambient air quality standards will depend on the severity of the air pollution problem within the region, the relative contribution of mobile and stationary emission sources, and the relative growth rates of these sources. Thus, the extent of auto use reductions will vary substantially among the air quality control regions in which they are needed. Table 10 displays the distribution of auto use reductions (measured as vehicle miles of travel) necessary to achieve nationwide compliance with the ambient air quality standards in 1977 and 1985. The projected VMT reductions needed in 1985 and beyond are highly uncertain. This is due to their extreme sensitivity to a number of parameters used in the projection calculation: namely, the relative contributions of different emissions sources, the growth rates of these sources, and the extent of stationary source control achievable. Accordingly, a broad range of the number of cities in each of two categories is shown; one category shows the number of cities needing between zero and 25 percent VMT reductions, the other shows the number of cities requiring VMT reductions larger than 25 percent. The actual reductions needed by the cities in this latter category will depend primarily upon the degree of stationary source control that can be achieved by 1985.

Table 9

Number of AQCR's Failing to Comply With Oxidant and/or CO Standard in Indicated Year[a]

	Calendar Year		
	1977	**1980**	**1985**
Without-In-Use Vehicle Controls[b]	21-24	12-14	9-10
With In-Use Vehicle Controls[c]	12-17	8-10	5-10

[a] Ranges reflect uncertainty in degree of stationary source control that will be achieved. Air quality projections are based on linear rollback for carbon monoxide and Ref. 4 for oxidant. Analysis excludes New York, Denver, Fairbanks.

[b] Control strategy consists of stationary source controls and FMVECP.

[c] Control strategy consists of stationary source controls, FMVECP, inspection/maintenance, and retrofit (including catalyst retrofit).

If present growth trends continue (Ref. 3), nationwide auto use (VMT) will be about 55 percent greater in 1985 than in 1972. Population growth, the increasing number of vehicles per person, and increasing annual mileage per vehicle all contribute about equally to this growth in vehicle miles of travel. Much of the reduction of auto use needed in the future is due to anticipated travel demand. If, for example, the number of vehicles per person and the annual mileage per vehicle remained constant through 1985, auto use would be only about 18 percent above current levels. This represents a VMT reduction of 25 percent from the projected baseline.

Table 10

Number of AQCR's Requiring Auto Use Reductions to Achieve Compliance with Oxidant and/or Carbon Monoxide

	Auto Use Reduction			
Calendar Year	**Less than 10%**	**10%-30%**	**30%-50%**	**50% or more**
1977	8	5	4	4
	0-25%	**25% or more**		
1985[b]	6-8	4-6		

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[a] The VMT reductions estimated for each AQCR are based on the additional control of motor vehicle emissions required, assuming the regional I/M and retrofit programs for in-use vehicles are fully implemented by 1977. Air quality projections are based on linear rollback for carbon monoxide and Ref. 4 for oxidant. The number of AQCR's whose current transportation control plans include auto use reductions exceeds the number used here because some plans have substituted VMT reduction for retrofit. Auto use reductions are expressed as percent reductions in vehicle miles travelled.

[b] Ranges reflect uncertainty in the degree of stationary source control that will be achieved and the future growth in automobile use.

Accordingly, the achievement of VMT reductions of this magnitude in the mid 1980's and beyond does not necessarily require severe restrictions on mobility by comparison with the present.

The need to curtail the rapid growth and, in some cases, reduce present levels of automobile use for reasons of air quality is twofold. First, compliance with the Clean Air Act requires that the prescribed ambient air quality standards be attained as rapidly as possible and, in accordance with the present statutes, no later than 1977. Furthermore, the emission levels of the automobile population will begin to increase sometime after 1985 if the current growth patterns continue. Thus, the need for reducing auto use to attain and maintain healthful air quality is not simply a consequence of the current statutory deadlines for achieving the ambient air quality standards. Rather, there will be a continuing need to develop and encourage the use of more extensive public transportation systems as an alternative to low occupancy automobile use.

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chapter 3 - methods of reducing automobile use

In Chapter 2 it was found that at least 21 AQCR's need reductions in automobile use to achieve the ambient air quality standards for the transportation-related air pollutants by 1977. Automobile use and emissions can be reduced by diverting automobile driver trips to other modes of transportation, notably transit and carpools. Compared to retrofit, this approach to emissions reduction has the significant advantage that it also helps to achieve important objectives such as energy conservation, increased mobility for persons who lack access to a car, reduced noise and congestion, and reduced need for further highway construction, in addition to improving air quality. The first two sections of this chapter describe the most significant determinants of transit and carpool usage and characterize the emissions reduction potential of transit and carpools. Specific measures for achieving diversions of automobile drivers to transit and carpools are discussed in Section 3.

1. Transit*

To attract significant numbers of automobile drivers out of their cars, a transit system must satisfy three conditions:

- It must have enough vehicles to carry the new riders.
- It must provide service whose quality is comparable or superior to that of the automobile. The most important component of service quality is travel time.
- Its cost to the rider must be attractive relative to the cost of operating an automobile.

An example of the relationship between travel time, cost, and transit ridership for work trips is illustrated in Figure 3, which is based upon the results of a study of travel behavior in Pittsburgh, Pennsylvania (Ref. 2). The variables included in the figure are the time to walk to and from the transit stop, the difference between automobile and transit travel times, the difference between automobile and transit costs, and the percentage of work trips taking place by transit. The importance of the time and cost variables in determining transit ridership can be illustrated by considering the case where transit and automobile travel times and costs are equal (Point A of Figure 3). The figure indicates that 66 percent of work trips would take place by transit. In contrast, average work trip transit ridership in the U. S. is currently less than 15 percent.

In practice, it is unlikely that transit can offer widespread service which is as fast as that of the car. A more realistic example of high quality transit is illustrated by point B of Figure 3. Here, the walk time is five minutes, transit travel time exceeds automobile travel time by 10 minutes, and the transit fare and automobile cost are equal. Transit ridership is 21 percent. If the walk and travel times remain unchanged and the automobile costs $2.00 per work trip more than transit owing to free transit, parking charges or other reasons, transit ridership for work trips increases to about 90 percent (point C).

The reductions in the combined emissions of automobiles and transit vehicles thus achieved depend on the kinds of transit vehicles used and the design and operation of the transit system. If, for example, diesel buses meeting the California 1975 heavy-duty diesel emissions standards are used and these buses carry an average load of 20 passengers, the reductions in combined bus and automobile emissions are roughly 30 percent for CO and HC and 15 percent for NO_x in 1977. In 1985, when automobile emissions will be less than in 1977, the CO and HC reductions are 20 percent and 25 percent respectively. However, NO_x emissions increase by about 20 percent. This NO_x increase would be eliminated if an average bus occupancy of 30 passengers were achieved.

These quantitative results are approximate owing to their reliance on a single behavioral study and rather crude measures of trip characteristics. However, the conclusion that high quality transit can attract high levels of ridership is also supported by the experience of existing high quality transit operations. For example, the Shirley Highway Express in the Washington, D. C. area, whose buses operate in specially reserved, congestion-free lanes, has achieved a peak period ridership of about 40 percent compared with 19 percent for the Washington area as a whole (Ref. 3, 4). In Los Angeles, charter buses are being used to carry workers from outlying residential areas to industrial employment centers. Service is provided on a subscription basis at a cost below that of the car. The bus operator estimates that the bus service carries over 90 percent of potential users.

Most transit systems in the U. S. do not provide the high quality service needed to attract high ridership. For example, nearly 50 percent of urban area residences are located three or more blocks from the nearest transit stop. Transit routes are heavily downtown oriented, but only about 10 percent of trips go downtown. Transit trips take nearly twice as long as automobile trips. Moreover, subsidized free or reduced rate parking confers a cost advantage on the automobile. Transit service of this quality is illustrated by point D of Figure 3. Ridership is 4 percent.

The direct monetary cost of transit depends on the detailed characteristics of the design and operation of the transit system. Average vehicle occupancies are especially important determinants of whether transit use will cost more or less than automobile use. For example, a commuter bus system that achieves average occupancies of 40 to 60 passengers per vehicle round trip is likely to cost about the same as automobile commuting (Refs: 1, 5). With lower occupancies, the cost of the bus system could exceed the cost of automobile operations by as much as $900 per commuter per year. Higher occupancy bus systems, however, could save over $100 per commuter per year relative to the cost of continued automobile operation. Thus, transit offers the possibility of achieving reductions in automobile emissions at a net cost saving if transit systems can be designed and operated so as to achieve both high quality service and high vehicle occupancies.

The foregoing indicates that the current low levels of transit usage in the United States are attributable to the poor quality of transit service relative to the service provided by the automobile. Substantial and enduring

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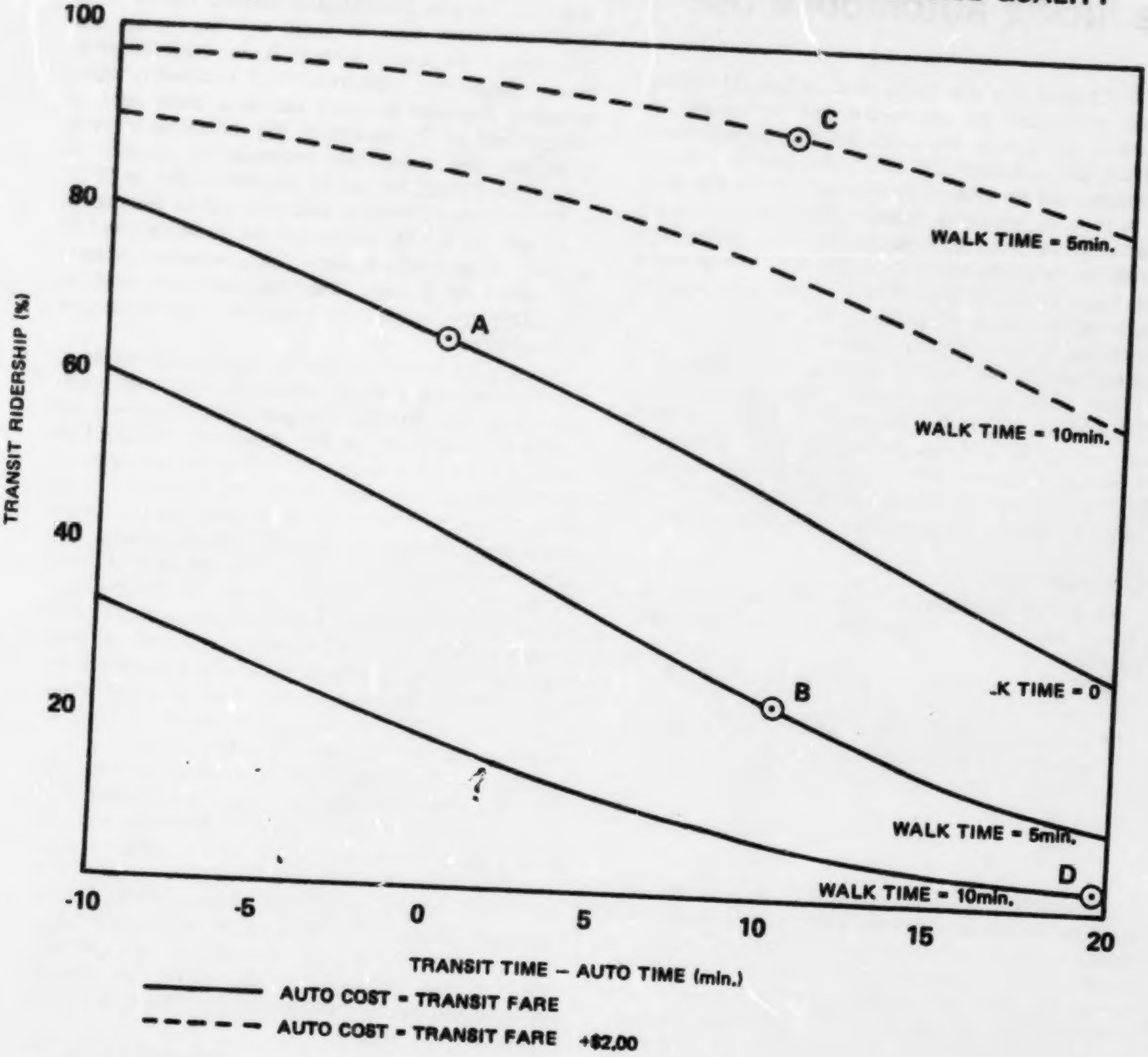
*Portions of this section and of Section 2 have been adapted, with permission, from Ref. 1.

Figure 3

DEPENDENCE OF WORK TRIP TRANSIT RIDERSHIP ON SERVICE QUALITY



reductions in automobile emissions can be achieved through the diversion of automobile drivers to transit if transit has adequate vehicular capacity and provides travel times comparable to the automobile at a cost to the rider that is attractive relative to the cost of driving a car. These emissions reductions will be available at a net cost savings if suitable transit vehicle occupancies can be attained. Measures that can be implemented to help achieve these goals are discussed in Section 3.

2. Carpools

Average automobile occupancy in the U. S. is about two persons per car. Average occupancy for work trips is about 1.4 persons per car (Ref. 6). Since most cars are capable of carrying at least four persons, there is considerable room for reducing automobile use and emissions through carpooling. The principal obstacle to carpooling is that carpools are highly restrictive in terms of the service offered. Carpoolers must have trip origins and destinations that are close to one another, must desire to travel at the same times of day, and, to minimize the problems of locating carpool partners, must make trips that are repetitive from day to day. As a result, the greatest potential for increased carpool use is in connection with peak-period work trips. These trips are responsible for about 25 percent of urban area automobile emissions (Ref. 7).

The present low auto occupancy rates for work trips indicate that substantial carpooling will not take place unless measures are implemented to encourage it. The limited experience to date with carpool programs has provided indications of the effectiveness of two possible approaches to encouraging carpools:

- Preferential treatment for carpools on streets and freeways.
- Parking restrictions combined with locator systems.

Preferential treatment for carpools has been observed to increase peak period auto occupancies by 10 to 30 percent (Ref. 8). Locator systems combined with parking restrictions appear capable of doubling occupancies for downtown peak period work trips and of increasing occupancies by 10 to 50 percent for peak period work trips to suburban locations (Ref. 9, 10). If these preliminary indications are confirmed by future experience, programs to encourage carpooling should be capable of reducing total urban area automobile emissions by 5 to 10 percent.

Carpooling and transit appear to be competitive, not complementary, approaches to reducing auto use. Both approaches operate most easily in connection with peak period work trips to high density areas, and transit improvements tend to attract carpoolers from their pools. It is therefore unlikely that the effects of transit and carpooling on auto use will be additive. For example, if transit improvements alone can achieve a 15 percent reduction in auto use and carpooling alone can achieve a ten percent reduction, the auto use reduction obtained from implementing both approaches together is likely to be greater than 15 percent but less than 25 percent.

Carpool programs are capable of achieving net cost savings. A carpool program for the Washington, D. C. area based on a locator system and parking restrictions is estimated to require an initial investment of $1.3 million and to have operating costs of $0.6 million per year (Ref. 4). If this system achieved a 3 percent increase in automobile occupancies for peak period downtown work trips, the resulting savings in automobile operating costs would equal the annualized cost of the system.

3. Measures to Encourage Transit and Carpool Usage

In Section 1 it was concluded that transit can attract auto drivers from their cars if the transit system has adequate vehicular capacity and can offer travel times and costs that are attractive relative to the automobile. Section 2 showed that carpooling can be encouraged through the use of parking restrictions and preferential treatment for carpools on streets and freeways. This section describes some of the principal approaches to improving transit service and encouraging the use of transit and carpools. Specifically, the following measures are discussed:

- Expansion of transit fleets.
- Improvement of transit route structures.
- Priority treatment for high occupancy vehicles.
- Automobile user charges and free or reduced fare transit.
- Parking restrictions.

No attempt has been made to enumerate or describe all possible means of improving transit or encouraging the use of transit and carpools. Rather, the discussion is restricted to the measures whose implementation is most important to the attainment and maintenance of the ambient air quality standards for transportation-related pollutants.

a. Expansion of Transit Fleets – Existing transit systems do not have the vehicular capacity to achieve large reductions in auto use. Most urban transit systems operate at more than 75 percent of capacity during peak periods. With this level of capacity usage, the maximum

Table 11

Bus Fleet Expansions Needed to Achieve Projected Reductions in Auto Use

City	EPA Estimate VMT Reduction %	EPA Estimate Buses	DOT Estimate VMT Reduction %	DOT Estimate Buses
Los Angeles	17	12,913	7	2533
San Francisco	14	3,310	7	787
Baltimore	4	377	13+	267
N. New Jersey	18	8,684	8	1840
Sacramento	9	501	7	186
San Diego	18	1,709	7	307
Phoenix/Tucson	8	802	8	386
Houston/Galveston	5	730	6	386
Denver	14	1,175	10	400
San Joaquin Valley	7	569	7	266
Boston	13	2,882	8	520
Washington, D.C. area	5	1,058	12+	467
Springfield, Mass.	9*	58	22*	40
New York City	5*	502	40*	213
Pittsburgh	6	663	1	26
Philadelphia	5	700	1	67
San Antonio	1	49	2	53
Salt Lake City	17*	116	19*	53
Seattle	10*	174	10*	80
Spokane	5*	174	7*	13
Portland, Oregon	10*	116	10*	53
Minneapolis	2	267	2*	27
Total		37,529		8970

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*CBD only +Peak period

reduction in auto use that can be achieved through the diversion of additional work trips to transit is about 5 percent. Achieving a 10 to 20 percent reduction in auto use could require expansions of existing bus fleets of at least 50 percent and, in some cases, over 500 percent, depending on the city, the design of the transit system, and the extent of carpooling. EPA's current estimates of the bus fleet expansions needed to fulfill the requirements of the transportation control plans are displayed in Table 11 together with estimates prepared independently by the Department of Transportation The EPA estimates are higher than the DOT estimates for the following reasons:

- In some cities EPA projects that transportation controls will achieve a greater reduction in automobile usage than DOT projects.
- EPA has assumed that increased carpooling will achieve 25 percent of the needed reductions in auto use, whereas DOT assumes that carpools will carry 75 percent of the diverted auto travelers.

Using EPA estimates, about 38,000 new vehicles are needed. At present, bus manufacturers operate with a single shift and are capable of producing 6000 to 6500 vehicles per year, or roughly 18,000 to 20,000 vehicles through 1977. With double shifts, roughly 36,000 to 40,000 vehicles could be produced through 1977.

b. Improvement of Transit Route Structures—Over 80 percent of urban area automobile emissions are caused by trips that originate and/or terminate in the suburbs. Over half of automobile emissions in urban areas are caused by intersuburban trips (Ref. 7, 11). Hence, programs directed toward achieving substantial reductions in urban area automobile emissions must include means of reducing emissions associated with suburban travel. In particular, the achievement of substantial reductions in automobile emissions through the diversion of automobile drivers to transit will be possible only if suburban automobile travellers are attracted to transit.

Most existing transit systems serve suburban areas very poorly. Present systems tend to have downtown oriented, radial routes which connect downtown locations with the suburbs but have few crosstown, circumferential, or intersuburban links. As a result of this route structure, route densities tend to be low in the suburbs, and access times are correspondingly high. In addition, transit travel between suburbs frequently requires a detour through downtown and, therefore, is difficult and time consuming. Table 12, which shows the geographical distribution of work-trip transit ridership in the Washington, D. C. area, illustrates the effect of radial route structure, among other things, on transit usage*. Transit ridership in the core is 65 percent; ridership to the core is 37 percent, and ridership in the suburbs is only 2 percent. These ridership differences reflect the long access and travel times associated with suburban travel on radial transit systems.

The provision of high quality transit service in suburban areas is often considered to be difficult or impossible owing to the problems of collecting and distributing passengers in low density areas. However, emerging trends in land use patterns and recent experience with innovative transit approaches suggest that many of these difficulties may be surmountable. For example, high density activity centers, which share many of the traffic and travel characteristics of the urban core, are developing in the suburbs of large cities (Ref. 12). Moreover, the success of the Shirley Highway bus system, which operates with fixed routes and schedules and whose principal mode of access is walking, illustrates the feasibility of attracting suburban residents to conventional transit for trips between suburban residential areas and high density employment centers. Finally, a variety of transit approaches now exist which are specifically designed for use in low density situations. These include park-and-ride, reservation and subscription service, dial-a-ride, and feeder bus systems that operate in either a demand responsive or conventional fashion.

c. Priority Treatment for High Occupancy Vehicles—The speed and reliability of bus service can be increased substantially by allocating highway facilities preferentially to buses through the use of reserved lanes on existing highways, specially constructed busways, or other means. In addition, certain forms of priority treatment can be applied to carpools so as to increase their speed and, thereby, their attractiveness. Within the last decade, over 200 bus priority treatments have been implemented or proposed in the United States and elsewhere (Ref. 13). Examples of bus priority treatment on freeways include:

- The San Bernardino Busway in the Los Angeles area and the Shirley Busway in Washington, D. C. area;
- Contra-flow bus lanes on the Long Island Expressway (New York City), I-495 in New Jersey, the Southeast Expressway in Boston, and U. S. 101 in Marin County;
- A special bus ramp for Seattle's Blue Streak express bus service, and the bus-carpool bypass lanes at the San Francisco-Oakland Bay Bridge toll plaza.

Examples of priority teatment on surface streets include:

- Dedicated bus streets in Chicago and Minneapolis;
- Contra-flow bus lanes in San Juan, Louisville, and San Antonio;
- Median bus lanes in Chicago and New Orleans, and curb bus lanes in most major cities.

Priority treatment can increase bus freeway speeds by a factor of two or more without significantly affecting auto speeds (Refs. 3, 13). Speed increases of up to 50

Table 12

Percentage Use of Transit to Work in the Washington, D. C. Area

From	**To:**	**Core**	**Urban**	**Suburban**	**Total**
Core		65.2	62.0	43.5	60.2
Urban		49.8	27.2	16.9	35.2
Suburban		19.2	4.2	1.9	6.7
Total		36.9	17.9	5.1	19.4

Source: Ref. 4

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*The ridership differences shown in Table 12 are not attributable solely to the radial route structure. There are substantial differences in income and auto ownership between the core and the suburbs.

percent have resulted from surface street priority treatment (Ref. 14). However, priority treatment does not always benefit buses relative to cars. For example, surface street bus lanes in Atlanta, Birmingham, and Baltimore have increased auto speeds more than bus speeds (Ref. 13, 15).

The elimination of congestion delays of buses through priority treatment can substantially improve bus service reliability. For example, the Shirley Busway has reduced the fraction of buses arriving more than six minutes late in Washington from 67 percent to about 10 percent (Ref. 3). The San Francisco - Oakland Bay Bridge bus/carpool lane has reduced late arrivals by buses from 84 percent to 45 percent in peak periods (Ref. 13).

The increased speeds resulting from priority treatment can reduce the number of buses needed to maintain given headways on a route. Maintaining the Shirley Busway headways would require approximately 14 additional peak period buses if the busway were not used (Ref. 3). The Chicago median bus lane has made possible the elimination of one peak period bus run (Ref. 13).

Bus priority treatment can also assist in the efficient utilization of highway facilities. A single freeway lane can carry about 2000 to 3000 persons per hour in cars (Ref. 16). This lane can carry at least 40,000 persons per hour in buses assuming no stops in lane (Ref. 13, 16). Similarly, a lane on an arterial street can accommodate at most about 1500 persons per hour by car but can carry 3500 more persons per hour by bus (Ref. 16). Thus, the substitution of bus use for auto use can substantially increase roadway person carrying capacities and, thereby, decrease the need for new highway facilities. For example, if the riders on the Shirley Busway had to be carried by automobile at current Shirley Highway auto speeds, about three additional lanes of freeway would be needed for each direction (Ref. 3).

The capital costs of existing and proposed freeway priority treatments are $1 million to $5 million per mile for busways (Ref. 13), $4,000 to $310,000 per mile for reserved lanes (Ref. 13), and $45,000 per mile for ramp metering (Ref. 17). Maintenance costs are $20,000 to $150,000 per mile per year for reserved lanes (Ref. 13) and about $25,000 per mile per year for ramp metering. Initial costs of surface street bus lanes are $3,500 to $10,000 per mile (Ref. 13). Maintenance costs apparently are absorbed in highway maintenance budgets and are not reported.

The experience to date with bus priority treatment suggests that the following considerations should be included in the planning of bus priority treatments in connection with air quality improvement programs:

1. Priority treatment can significantly improve bus travel times only if it is implemented over a substantial portion of a bus route. For example, the Second Avenue curb bus lane in New York has increased bus speeds by nearly 30 percent but, because it is only two miles in length, saves only two minutes of travel time (Ref. 13). An equal speed increase over a 10 mile route could save 10 minutes of travel time and might have an important influence on mode choice. A corollary to this observation is that bus priority treatment is likely to be of significant benefit only to relatively long distance travellers. For example, the Shirley Busway saves over 20 minutes for long distance travellers but only two to three minutes for travellers from close-in locations (Ref. 3).

2. Bus priority treatment should include both the freeway and surface street portions of transit routes. For example, the typical trans-bay transit route in the San Francisco area is 16 miles long with 10 miles on freeways and 6 miles on surface streets. The average speeds are about 35 mph on freeways and 15 mph on streets (Ref. 13). If priority treatment increased speeds to 55 mph on freeways and 20 mph on streets, 6 minutes would be saved on each portion of the route. Thus, the total time savings is double that resulting from priority treatment on streets only or freeways only.

3. Anticipated bus volumes should not exceed lane capacities. Priority treatment may reduce bus speeds if surface street bus lanes are required to carry more than about 100 buses per hour with in-lane stops (Ref. 16). If existing or anticipated bus volumes exceed lane capacity, consideration should be given to alternating bus stops, constructing bus bays, reserving additional lanes for bus use or reserving the entire street for buses.

4. Mode shifts from auto to bus concurrent with bus priority treatments must be large enough to compensate for increases in per vehicle auto emissions that may result from any traffic congestion that may be produced by the priority treatment. Determining whether this condition is fulfilled for an entire city requires detailed modeling of the relationships between traffic patterns before and after implementation of priority treatment. For an individual street, the EPA speed-emissions relationships (Ref. 18) suggest auto emissions on the street will not increase if, following the implementation of bus priority treatment, the percent reduction in auto trips along the street exceeds the percent reduction in auto speeds caused by any increased congestion on the street.*

5. Bus priority treatments cannot be planned independently of other transit improvement or traffic management measures. The effects of bus priority treatment on transit ridership, auto usage, and emissions are, in general, dependent on the state of the existing transit system and the nature of any other transit improvement or traffic management measures that may be taken. This can easily be seen by considering the extreme example of a freeway on which no buses currently operate. Reservation of a lane for buses on the freeway can only aggravate air quality problems if the transit system remains otherwise unchanged. But the reserved lane may be justified if its implementation coincides with the inauguration of express bus service on the freeway. Conversely, priority treatment for buses on a certain street may be justified under existing conditions but not if it coincides with bus dedication of an adjacent street that results in the diversion of large volumes of traffic to the first street. Thus, bus priority treatments and other potential transit improvement and traffic management measures must be evaluated collectively. The planning of priority treatments cannot be

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*Bus priority treatment does not necessarily increase congestion on a street even if automobile traffic volumes remain unchanged. For example, removing a parking lane and substituting a bus lane increases roadway capacity. Moreover, a bus lane replacing a mixed traffic lane also can increase capacity by removing the friction of lane changes and by channelling buses into one lane.

separated from the rest of the transit planning process.

The Use of Bus Lanes by Carpools—In Section 2 it was observed that auto occupancies can be increased by providing preferential treatment for carpools. Assuming the availability of the necessary lane capacity, there appear to be no engineering or safety problems associated with the use of surface street bus lanes by qualified cars. Indeed, taxis make use of bus lanes in many European cities. However, enforcement of a qualified car rule will be difficult if qualified cars are not readily distinguishable from other cars.

The use of reserved normal-flow freeway lanes by carpools could pose both enforcement and safety problems. The enforcement problem is associated with distinguishing between qualified and unqualified cars. The principal safety problem is the speed difference between the reserved lane and the adjacent unreserved lane. The most extensive experience with bus/carpool sharing of a reserved lane is from the San Francisco-Oakland Bay Bridge (Ref. 8). There, no safety problems have been encountered. However, during the first months of operation as many as 30 percent of the vehicles using the bus/carpool lane were found to be in it illegally, and it was necessary to place plastic stanchions at 12 foot intervals along the lane line to discourage violations. In addition, it has been necessary for the California Highway Patrol to undertake a vigorous enforcement campaign.

California also is experimenting with bypass lanes for carpools at metered freeway ramps. So far, enforcement appears to be less of a problem at the metered ramps than on the Bay Bridge. Only about 10 percent of the cars using the bypass lanes have been found to be in them illegally, although the use of the bypass can save as much as 8 minutes of travel time (Ref. 8). However, active enforcement of the lane-use rules is necessary to maintain this level of violations.

The use of contra-flow freeway lanes by cars is generally considered to be unsafe.

d. Automobile User Charges and Free or Reduced-Rate Transit—The use of automobiles in cities, particularly for peak period, downtown and commuter travel, is greatly underpriced. One source of this underpricing is free or reduced-rate parking. For example, the commercial price of all day parking in downtown Washington, D. C. is roughly $2.00 per day. Yet, a survey of auto commuters in the Shirley Highway corridor found that 56 percent of the auto users parked free, and over 80 percent paid $1.00 per day or less (Ref. 3). Similarly, a study for the Department of Transportation by the Institute for Defense Analysis (Ref. 19) concluded:

> Present auto road-user charges, consisting primarily of gasoline taxes, are less than $.015 per mile. This is far below the real cost of using the road in both peak ($.29) and base ($.07) periods . . . . Clearly peak-hour private auto travel is heavily subsidized. Charges sufficient to cover the true costs of auto travel in urban areas would surely cause a major restructuring of travel behavior and urban form.

Underpricing of automobile use imposes a significant cost disadvantage on transit from the traveller's point of view. It encourages the excessive use of automobiles in cities, particularly for work trips, and has contributed to the decline of the transit industry in the United States. As shown in Section 1 of this chapter, if the relative user costs of transit and automobiles were changed by an amount that reflected the current underpricing of automobile use relative to transit use, a substantial diversion of automobile drivers to transit and reduction in automobile emissions could be achieved, assuming that suitable transit facilities were available.

There are two basic ways in which the imbalance between transit and automobile user costs might be reduced. One is to reduce transit fares. The other is to increase the cost of automobile use. Several studies and experiments with free or reduced-rate transit have been conducted in the United States in recent years. These have generally concluded that transit fare reductions alone are likely to have little effect on automobile use and that transit service improvements are of much greater importance in attracting automobile users to transit. In Atlanta, for example, a reduction in the basic fare from $0.40 to $0.15 together with only minor service improvements resulted in the diversion to transit of only about 20,000 automobile trips per day, roughly 2 percent of daily automobile trips (Ref. 20). A study of free transit in Boston concluded that free transit would have a negligible effect on auto shopping trips and would reduce auto work trips by only about 14 percent. This corresponds to roughly a 5 percent reduction in daily automobile emissions.

A likely explanation of the discouraging results of these and other studies of reduced-rate transit is that the fare reductions were not accompanied by adequate improvements in transit service. Several studies of the relationship between transit usage, travel times, and travel costs have indicated that the response of auto drivers to changes in the relative costs of transit and auto travel increases as the quality of transit service improves (Ref. 2, 22). Whereas modest reductions in auto use can be expected from fare reductions associated with high quality transit service, little change in auto use can be expected if transit service is poor. As explained in Section 1 of this chapter, most existing transit systems offer poor quality service relative to the automobile. The reduced-fare transit experiments included relatively minor service improvements. Thus, auto drivers for whom transit was already prohibitively time consuming or unavailable could not benefit from the reduced fares and did not switch to transit. It is, therefore, not surprising that the studies of reduced-fare transit service have found that fare changes on an otherwise poor transit system have little effect on automobile travel. It remains to be determined whether actual experience with high quality transit will confirm the aforementioned hypothesis that fare reductions on good transit systems can produce modest reductions in auto use.

The second approach to rectifying the imbalance in the relative user costs of transit and the automobile is to increase the price of automobile use to reflect the true costs of automobile use. There are several reasons why increasing auto user charges in this manner is a more attractive option than reducing transit fares:

- The existing cost imbalance is caused by the underpricing of auto use, not the overpricing of transit use. Thus, reduced transit fares will aggravate the underpricing of urban transportation.
- The underpricing of automobile use can exceed $2.00 per commuter round trip, whereas the average transit fare is about $0.60 per round trip

(Ref. 23). Therefore, unless transit fares are unusually high, fare reductions will not fully compensate for the current underpricing of the automobile and cannot be as effective in reducing auto use as auto user charges.

- Reduced fares will require transit to be subsidized indefinitely. However, auto user charges could assist in the attainment of the high vehicle occupancies needed to make transit efficient and self-supporting.

The principal disadvantage of increased auto user charges is that they are burdensome to the public unless high quality transit is available over widespread areas. Whereas transit fare reductions and quality improvements can be implemented independently, major transit service improvement should precede or take place concurrently with increases in auto user charges.

Methods of charging for the costs of auto use include increased registration fees, increased fuel costs, road use charges, parking taxes, and the sale of licenses for access to selected areas within a city. Apart from their possible inclusion in emissions reduction programs, many of these methods of increasing the costs of auto use have been proposed or implemented in connection with programs to reduce fuel consumption, ease traffic congestion, or encourage transit use. For example, in 1967 J. M. Thomson (Ref. 24) found that:

> Traffic congestion has become an important social and economic problem. One possibility of reducing congestion is to impose special charges on traffic using congested roads.

Thomson estimated that requiring a 6 shilling daily license for access to Central London would reduce automobile traffic there by about 50 percent and that a 9 pence hourly parking tax (which has no effect on through traffic) would reduce automobile traffic by about 25 percent in peak periods and 10 percent at other times. Subsequently, Thomson reported (Ref. 25) that:

> In London the Greater London Council have obtained licensing powers to control the prices charged by private parking companies. The objectives are to prevent the prices from being too low and to control the structure of charges in order to discourage long-term parkers and other peak hour traffic.

J. M. Armour (Ref. 26) has described a similar policy in Glasgow:

> The Highway Plan [for Glasgow], now being implemented, involves a restraint on entry to the central area . . . . Control may be exercised by setting a limit to the number of [parking] spaces to be provided, the charges to be made for parking and the times when certain spaces may be opened and closed . . . . It is expected that the number of spaces for which parking charges must be paid will increase from 800 (out of 18,000 in 1971) to 18,000 (out of 21,000) by 1980.

Automobile user charges have also been proposed to remedy transportation problems in the United States. For example, a report to the Department of Transportation by the London Transport Executive on methods of encouraging increased transit usage by commuters in U. S. cities (Ref. 27) included the following recommendation:

> Scales of charges and period structure should be regulated to insure that at least the full economic return for the parking facility (including land cost) is recovered. Where necessary, rates should be adjusted upwards to assist in achieving the right economic balance between the perceived cost of motoring and the cost of public transit fares. Rates should also be adjusted to insure that provision for all-day commuter parking is kept to the minimum commensurate with overall policy and that commuting rates are substantially in excess of short term rates.

In another report, on improving transportation in the Washington, D. C. area (Ref. 28), London Transport included the following recommendation, which it considered "likely to have particular impact and merit":

> Obtain Congressional authority for, and implement on a phased basis, a policy of charging Federal employees at the appropriate commercial rate for parking their private cars in Federal agency parking accommodation . . . .

A downtown parking plan proposed for Portland, Oregon includes the recommendation that new parking facilities be priced to encourage the use of peripheral parking by commuters (Ref. 33).

To be effective in reducing automobile use and emissions, automobile user charges should be assessed on daily auto use. Moreover, the charges should be sufficiently flexible to distinguish between travellers who can switch to transit relatively easily (e.g., commuters) and those who cannot (e.g., certain kinds of shoppers). The charges should also be capable of distinguishing between geographical areas where transit is available and those where it is not. In areas where transit is poor, auto user charges could be phased in gradually as transit is improved, and the revenues thus raised could be used to pay the costs of the transit improvements. Among the various possible methods of assessing auto user charges, daily licenses, parking taxes, and certain approaches to road-user tolls come closest to satisfying these criteria. Auto registration fees are neither flexible nor closely related to daily auto use. Fuel taxes, in addition to being inflexible, have the disadvantage that they can be avoided through the purchase of a smaller car, which uses less fuel – but does not pollute less – than a large car. Moreover, the fuel cost increases needed to compensate for the underpricing of parking can be quite large. For example, a commuter who lives 10 miles from work would have to be assessed a fuel surcharge of roughly $1.50 per gallon to achieve equivalence with a $2.00 per day parking fee.

There has been little direct experience with auto user charges in the United States. Indeed, present public policy tends to work in the opposite direction from the one desired: registration fees are often lower for old, heavily polluting cars than for newer and cleaner ones; tolls are imposed to pay for facilities when they are new and uncrowded but are removed when the facilities are paid for, which is when tolls are most needed; monthly auto commuter tickets are available at a discount under daily tickets; and long-term parking is frequently cheaper per hour than short-term parking.

The only known place where the "before and after" effects on traffic of a parking tax have been studied is San Francisco. There, a 25 percent parking tax was enacted in 1970 and remained in force until it was reduced to 10 percent in 1972. The purpose of the tax was to generate revenue for the city. A retrospective study of the effects of the tax (Ref. 29) reported that the tax reduced traffic in San Francisco by less than 2 percent. This result is not surprising. The tax increased the average cost of paid parking by only $0.25; it affected only 20 percent of daily vehicle trips in San Francisco; and, like the reduced-fare transit experiments, it was not accompanied by significant transit improvements.

The San Francisco experience and the reduced-fare transit experiments show that modest changes in the relative costs of transit and automobile travel are not a substitute for transit service improvements. However, as observed in the discussion of reduced fare transit, the response of auto drivers to changes in the relative costs of auto and transit travel is likely to increase as transit service improves. Means of improving transit service include fleet expansions, route restructuring and bus priority treatment. The discussion in Section 1 of this chapter and the work of Thomson indicate that suitably structured auto user charges, if implemented in conjunction with the provision of high quality transit service, can be highly effective in reducing automobile use in cities.

e. Parking Restrictions—An alternative means of compensating for the underpricing of automobile use in cities and of discouraging the excessive use of automobiles is to restrict the availability of parking spaces. The following examples demonstrate that parking restrictions can be effective in encouraging transit and carpool use, discouraging automobile use, and improving air quality:

- In Washington, D. C., Federal agencies have adopted programs to encourage carpooling. A highly successful example is the National Aeronautics and Space Administration, which allocates parking permits preferentially to carpools. An average automobile occupancy of 3.85 persons per car, nearly triple the normal rate, has been achieved (Ref. 9).
- In London, England, the moving of employees from a building with low parking provision to one with high provision has resulted in a significant increase in automobile use for commuting purposes (Ref. 27).
- A survey of motorists parking in Central London found that if parking were not available, 62 percent of the motorists would switch to public transit in preference to other options such as using taxis, walking, bicyclying or foregoing their trips. Only 4 percent of the motorists reported that a car was essential. (Ref. 25).
- When a strike caused the closing of 80 percent of the parking spaces in downtown Pittsburgh, Pennsylvania, 75 percent of commuters switched to transit, and peak period traffic in the central business district declined by 25 percent (Ref. 30).
- A total ban on parking in downtown Marseilles, France produced a 40% reduction in carbon monoxide concentrations (Ref. 31).

In England, parking restrictions are a frequently used means of regulating traffic. Many parking facilities there remain closed until 9:30 a.m. to exclude commuters (Ref. 27). In London, zoning regulations place a ceiling on the maximum number of parking spaces that can be provided in new office developments (Ref. 27). The Glasgow Highway Plan provides for 27,000 parking spaces in the central area in 1990 despite an estimated potential demand of 65,000 spaces (Ref. 26). In the Leicester plan, a ceiling of 22,500 parking spaces has been established, whereas there would be demand for 67,000 spaces if unlimited use of cars were permitted (Ref. 25).

The London Transport Executive report on parking policy to encourage greater transit use by U. S. commuters (Ref. 27) included the following recommendations:

- . . . Regulation of [parking] capacity should be used as a tool to assist in securing the desired modal split between public and private transport in accordance with transport policy for the city concerned.
- As a . . . deterrent to all-day commuter parking, some parking garages or lots should if necessary remain closed until after the normal starting times for commuters.

Parking limitations to control traffic volumes and improve air quality are not intended to restrict access to the affected parts of cities. Rather, they are intended to influence the mode of access. Thus, parking restrictions, like free transit and automobile user charges, are not a substitute for transit improvements or other means of providing alternatives to low occupancy automobile travel. Moreover, parking restrictions should be designed so as to have their greatest influence on those automobile travellers who can most easily switch to other modes.

The structure of parking restrictions can have a significant influence on the types of trips affected by the restrictions. Commuters are among the travellers most readily attracted to transit. Thus, one of the principal objectives of parking restrictions should be to influence commuter mode choice. Restrictions of long term parking or of parking during the morning peak period will serve this objective. However, simple reductions in the total quantity of available parking in an area may not affect commuters at all. For example, downtown parking space is frequently allocated on a first-come first-served basis or through monthly contracts. Since commuters tend to arrive downtown earlier than other travellers, are major contract users, and are responsible for nearly half of the downtown parking demand in U. S. cities (Ref. 32), simple reductions in available parking space downtown are likely to result in the consumption of the remaining space by commuters and the restriction of non-work travellers.

Parking restrictions that apply only to on-street parking are likely to have little effect on either traffic volumes or air quality. For example, in downtown areas, on-street parking accounts for less than 20 percent of commuter parking and 15 percent of total parking (Ref. 32). Since about 55 percent of downtown traffic is through traffic that does not park, a complete prohibition of on-street parking could affect no more than 6 percent of downtown traffic. If, as is frequently the case, there exists excess off-street parking capacity, the effect of the on-street restrictions will be even less. Thus, to be effective, parking restrictions must include off-street spaces.

The availability of excess parking capacity can strongly influence the effectiveness of parking restrictions in reducing traffic volumes. For example, total parking capacity in the downtown areas of large cities tends to exceed demand by roughly 30 percent. This does not necessarily imply that all parking facilities have excess capacity. However, it does mean that parking restrictions must be designed to take account of the varying degrees of excess capacity that may exist among various locations. Failure to do this may cause parking restrictions that appear extremely stringent to be ineffective in reducing traffic. For example, in a typical downtown area a total prohibition of on-street parking (13 percent reduction in total spaces) and a 25 percent reduction in public off-street parking (64 percent of capacity) could have the effect of reducing available parking by only 29 percent. This might just eliminate excess parking capacity and, thus, produce no reduction in downtown traffic.

In summary, parking restrictions can be effective in reducing automobile traffic and improving air quality. However, their effectiveness is contingent upon satisfying the following conditions:

- The restrictions should be accompanied by the provision of alternative modes to the low occupancy automobile.
- The restrictions should be structured so as to affect those automobile travellers most likely to switch to other modes.
- Off-street parking should be included in the restrictions.
- The restrictions must be sufficiently stringent to reduce the quantity of occupied parking space as well as excess capacity.

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chapter 4 - transportation control regulations

1. Legal Background

Section 109 of the Clean Air Act (42 U.S.C. 1857c-4) requires the EPA "within thirty days after the date of enactment of the Clean Air Amendments of 1970" to publish proposed regulations for setting forth a national primary air quality standard "for each air pollutant for which air quality criteria have been issued prior to such date of enactment" and to promulgate them within 90 days after proposal.* The Act requires that the primary standards protect the public health with an adequate margin of safety and that the secondary standards protect the public welfare from any known or anticipated adverse effects.

"Criteria documents", which are comprehensive summaries, written and reviewed by broadly based and technically qualified groups, of the adverse health and welfare effects of various air pollutants, had been prepared for carbon monoxide and photochemical oxidants, the two air pollutants caused largely by the automobile, prior to the enactment of the Clean Air Amendments on December 31, 1970. Accordingly, primary standards for these pollutants were promulgated on April 30, 1971. 36 Federal Register 8186 (April 30, 1971).

Under Section 110 of the Act (42 U.S.C. 1857c-5) States were required to prepare and submit to the Administrator plans for implementing the national ambient air quality standards in each air quality control region in the State within nine months after that standard had been promulgated. Four months after the end of that nine month period, the Administrator was required to announce whether the plans so submitted were approvable under the conditions set forth in Section 110(a)(2)(A)-(H).

If the Administrator disapproved a State plan or portion thereof, or if a State failed to submit an implementation plan or portion thereof, he was required under Section 110(c) of the Act to propose and subsequently promulgate regulations setting forth a substitute implementation plan. If regulatory portions of a State plan, including control plans and related rules and regulations, were disapproved or were not submitted, regulations setting forth substitute portions were to be proposed.

Section 110(a) requires that a valid implementation plan set forth a control strategy that attains the ambient standards as expeditiously as practicable, but no later than three years from the date the Administrator's approvals and disapprovals were announced. Thus, the standards must be achieved no later than May 31, 1975. For those areas that cannot achieve the standards by this date, an extension under Section 110(e) of the Act may be granted. To quality for any extension, a plan must demonstrate that certain elements of the necessary control strategy will not be available by 1975; that there are no earlier, unused alternatives to these delayed elements; and that available emissions controls will be applied as soon as possible.

The effect of the requirement that an extension be granted for a specific control measure only if "the necessary technology is unavailable," if "reasonably available alternative means" of emission reduction are considered and applied, and if "interim measures of control" that the Administrator determines are "reasonable under the circumstances" are applied, is to assure that the standards are attained "as expeditiously as practicable." In essence, if a control measure is "technologically feasible", "practicable", "available", and "reasonable . . . under the circumstances," it should be part of a plan before any extension is given for other measures whose implementation in 1975 would not be technologically feasible, practicable, available or reasonable under the circumstances. This provision of the Act applies to plans promulgated by EPA as well as to those submitted by the States. If EPA believed that such an extension would be needed for a region, the proposal to grant such extension was included in the promulgated plan.

The adopted implementation plan must provide unconditionally and without regard to cost for achieving air quality standards by 1977, even if the maximum possible extension under Section 110(e) is granted. However, under Section 110(f) a further extension of up to one year in the applicability of a portion of such a plan may be granted by the Administrator if the Governor of the State involved applies for it and if it is shown in a formal hearing that:

- Good faith efforts have been made to comply with the portion of the plan involved
- Compliance with the affected portion of the plan is impossible because "the necessary technology or other alternative methods of control are not available or have not been available for a sufficient period of time"
- [A]ny available alternative operating procedures and interim control measures have reduced or will reduce the impact of [the sources that would be controlled by the deferred plan requirement] on public health"
- "[T]he continued operation of [the sources involved] is essential to national security or to the public health or welfare."

The presence in the ambient air of carbon monoxide and photochemical oxidants is largely attributable to motor vehicles. Consequently, many States were unable to formulate and submit adequate control strategies for these pollutants utilizing only limitations on emissions from stationary sources. However, as the Administrator noted in his May 31, 1972 approval/disapproval of implementation plans, neither the States nor the Environmental Protection Agency had any practical experience that would permit the development of meaningful transportation control plans or the prediction of their effects on air quality. Consequently, States were advised in August 1971 (36 FR 15486) that adoption of transportation control plans could be deferred beyond the statutory deadline for submittal of implementation plans but that the submitted plans would have to define the degree of emission reduction to be achieved through transportation control measures and identify the measures being considered. Transportation control plans were to be designed to augment the existing State implementation plan and the Federal Motor Vehicle Control Program (FMVCP). States were required to submit adopted transportation control plans no later than February 15, 1973.

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*Quotations in this section are from the Clean Air Act.

Many States requested 2-year extensions pursuant to Section 110(e) of the Act (42 U.S.C. 1857-5(e)) for the attainment of the primary standards for the auto-related pollutants based on the unavailability of transportation control measures. The Administrator determined that, in fact, transportation control measures would not be available soon enough to permit attainment of the primary standards within the three-year time period prescribed by the Act; therefore, two-year extensions were granted at the request of those States that had determined that transportation control measures would be necessary. In some cases, this meant that States were required to submit on February 15, 1973 transportation and/or land use control measures that would achieve the standards by 1977. In other cases, the two-year extension meant that certain States would not have to submit transportation control measures because the FMVCP and/or stationary source control would be adequate to achieve the standards by 1977 without the application of any other transportation and/or land use measures.

The Administrator's decision to defer transportation control plans and to grant two-year extensions to all States requesting them led to two lawsuits against EPA, both of which succeeded. The first involved Los Angeles only and was brought by the cities of San Bernardino and Riverside together with certain environmental groups. *City of Riverside v. Ruckelshaus*, 4 ERC 1728 (C.D., Calif., 1972). The court there ruled on November 16, 1972, that the Administrator had acted illegally in deferring the transportation control plan for Los Angeles, and ordered him to propose such a plan by January 15, 1973. The court order stated explicitly that "such proposed regulations shall demonstrate that the national primary ambient air quality standard for photochemical oxidants shall be attained within three years of the date of final adoption [or, if the two-year extension mentioned above had been granted, within five years]".

The second lawsuit was brought by a collection of national environmental groups in the United States Court of Appeals for the District of Columbia Circuit. *Natural Resources Defense Council v. EPA*, 475 F.2d 968 (D. C. Cir. 1973), hereafter citied as the *NRDC* case. It involved transportation control plans for all cities other than Los Angeles and maintenance of all national ambient air quality standards once they are achieved.

With respect to transportation control plans, the court held that while the Administrator acted "in the best of faith," the Clean Air Act did not permit the delay in submission of transportation control portions of State implementation plans until February 15, 1973, or permit the granting of extensions to mid-1977 for attainment of the national primary air standards where plans had not been submitted. The order required the Administrator to formally rescind through notice to the States and publication in the *Federal Register* the extension of time granted for submission of transportation and/or land use control portions of implementation plans. It also required the Administrator to formally rescind in the same manner the extension granted to several States to delay implementation of their plans or portions thereof until May 31, 1977. The court further ordered the Administrator to inform the States concerned that all States that had not yet submitted an implementation plan fully complying with the requirements of the Clean Air Act of 1970 were to submit such a plan by April 15, 1973. That plan would have to satisfy each and every requirement of Section 110(a)(2)-(A)-(H) if it were to be approved by the Administrator.

In accordance with this order, 22 States including the District of Columbia were notified by telegram on February 5, 1973, that any extensions granted because of the unavailability of transportation and/or land use controls were canceled and that plans for the attainment and maintenance of the standards for the three pollutants would be required by April 15, 1973. A *Federal Register* notice was issued on March 20, 1973, (38 FR 7323), to complete the requirements of that court order. This notice provided that every State granted an extension to achieve the transportation-related air quality standards and/or permitted to defer submittal of the transportation and/or land use control strategies until February 15, 1973, would be required to submit no later than April 15, 1973, transportation and/or land use controls showing achievement of the standards by 1975. In addition to those States that were required to submit transportation and/or land use control strategies on February 15, 1973, a number of other States, which had regions that would not achieve the standard by 1975 but which had not been required to submit transportation control strategies because the FMVCP was capable of achieving the standards by 1977, were required to submit transportation control strategies on April 15, 1973. States that were not granted an extension but which had deficient plans were also required to submit transportation control strategies on April 15, 1973. Strategies adopted by the States had to provide for attainment and maintenance of these standards by May 31, 1975. At the time of submission of a plan on April 15, 1973, the Governor of a State could request an extension up to 2 years for compliance with the provisions of these plans if the specific requirements of Section 110(e) were satisfied by the State plan.

2. Air Quality Considerations

After the court order in the *NRDC* case, EPA advised the States of the potential need for transportation control plans in 39 metropolitan areas. Table 13 shows the air quality levels in each area used to assess the need for transportation controls. The table also shows the estimated reductions in hydrocarbon and/or carbon monoxide emissions required to achieve the air quality standards, the emission reductions that were expected by 1975 as a result of the FMVCP and existing stationary source controls, and the emissions reductions that had to be achieved through additional stationary source controls and/or transportation controls.

Seven of the 39 areas listed in Table 13 were found capable of achieving the air quality standards in 1975 through existing stationary source controls and the FMVCP. In addition, transportation controls are not needed in the Indio area in California, as the elevated oxidant levels in this area are caused by pollutant transport from Los Angeles. The remaining 31 areas need additional emissions reductions of 5 to 59 percent. Seven of these areas could achieve the air quality standards by 1975 through the implementation of additional stationary source controls (2 areas) or through the use of such transportation controls such as inspection and maintenance or transit improvements (5 areas).

TABLE 13 – Air Quality Summary for 39 Metropolitan Areas[a]

		Oxidant		Carbon Monoxide		% Reduction in 1975 from FMVCP and Existing Stationary Source Controls		Additional Reductions Required (%)	
State	City	Concentration (ppm)	% Hydrocarbon Reduction Needed	Concentration (ppm)[b]	% Reduction Needed	Hydro-carbon	Carbon Monoxide	Hydro-carbon	Carbon Monoxide
Alabama	Birmingham	.10	18	14	37	47	53	0	0
	Mobile	.14	41	NA[d]	NA	52	NA	0	0
Alaska	Fairbanks	NA	NA	27	66	NA	14	0	52
Arizona	Phoenix	.13	31	26	66	31	26	0	40
California	Los Angeles	.62	93	41	78	34	34	59	44
	Sacramento	.28	72	22	59	17	21	50	38
	San Diego	.32	75	18	50	34	34	41	16
	San Francisco	.36	78	18	48	19	33	59	15
	San Joaquin V.	.24	67	15	40	20	19	47	21
	Indio	.38	70	17	47	Dependent on Los Angeles Reductions			
Colorado	Denver	.18	60	25	64	12	14	48	50
District of Columbia[c]	Washington	.20	67	20	56	31	30	36	26
Illinois	Chicago	NA	NA	18	50	NA	40	0	10
Indiana	Indianapolis	.13	38	12	25	19	25	19	0
Missouri	Kansas City	NA	NA	14	29	NA	30	0	0
Louisiana	Baton Rouge	.13	40	NA	NA	55	NA	0	0
Maryland	Baltimore	.21	70	21	57	25	20	45	37
Massachusetts	Boston	.25	68	22	59	24	34	44	25
	Springfield	NA	NA	21	57	NA	16	0	41
Minnesota	Minneapolis	NA	NA	15	40	NA	29	0	11
New Jersey	Camden-Trenton	.15	47	30	70	27	20	20	50
	Newark	.20	67	17	47	34	20	33	27
New York	New York	.20	67	40	78	48	33	19	45
	Rochester	.14	45	NA	NA	38	NA	7	0
	Syracuse	NA	NA	11	25	NA	29	0	0
Ohio	Cincinnati	.14	43	NA	NA	38	NA	5	0
	Dayton	.12	30	NA	NA	43	NA	0	0
	Toledo	.15	50	NA	NA	50	NA	0	0
Oregon	Portland	.14	43	23	60	30	26	13	34
Pennsylvania	Philadelphia	.13	54	20	55	17	32	37	23
	Pittsburgh	.15	49	21	57	35	28	14	29
Texas	Austin	.11	27	NA	NA	19	NA	8	0
	Dallas	.12	34	NA	NA	22	NA	12	0
	El Paso	.12	34	NA	NA	22	NA	12	0
	Houston	.32	75	NA	NA	36	NA	39	0
	San Antonio	.14	45	NA	NA	19	NA	26	0
Utah	Salt Lake City	NA	NA	22	59	NA	11	0	48
Washington	Seattle	NA	NA	20	55	NA	18	0	37
	Spokane	NA	NA	18	50	NA	21	0	29

Notes: [a] Based on information in State implementation plans. [b] Eight-hour average. [c] Including Maryland and Virginia Suburbs. [d] Not applicable.

TABLE 14 – Air Quality Summary for Metropolitan Areas Granted Time Extensions[a]

		Oxidant		Carbon Monoxide			% Reduction from FMVCP & Existing Stationary Source Controls[c]		Additional Reductions Needed (%)	
State	City	Concentration (ppm)	% Hydrocarbon Reduction Needed	Concentration (ppm)[b]	% Reduction Needed	Extension Compliance Date	Hydro-carbon	Carbon Monoxide	Hydro-carbon	Carbon Monoxide
Alaska	Fairbanks	NA[d]	NA	27	66	1977	NA	32	NA	34
Arizona	Phoenix	.13	31	26	66	1977	NA	37	NA	29
California	Los Angeles	.62	93	41	78	1977	47	47	46	31
	Sacramento	.28	72	22	59	1977	21	34	51	25
	San Diego	.32	75	18	50	1977	48	47	27	3
	San Francisco	.36	78	18	48	1977	25	43	53	5
	San Joaquin V.	.24	67	17	47	1977	32	24	35	16
Colorado	Denver	.18	60	25	64	1977	23	31	37	33
District of Columbia[e]	Washington	.20	67	20	56	1977	47	49	20	7
Maryland	Baltimore	.21	70	21	57	1977	37	25	33	32
Massachusetts	Boston	.25	68	22	59	1977	33	50	35	9
	Springfield	NA	NA	21	57	1977	NA	27	NA	30
New Jersey	Camden-Trenton	.15	47	30	70	1977	30	33	17	37
	Newark	.20	67	17	47	1977	45	29	24	18
New York	New York	.20	67	40	78	1977	55	48	12	30
Oregon	Portland	NA	NA	23	60	1976	NA	39	NA	21
Pennsylvania	Philadelphia	.13	54	20	55	1976	34	44	21	12
	Pittsburgh	.15	49	21	57	1977	46	48	4	9
Texas	Dallas	.12	34	NA	NA	1976	27	NA	7	NA
	Houston	.32	75	NA	NA	1977	65	NA	10	NA
	San Antonio	.14	45	NA	NA	1977	29	NA	16	NA
Utah	Salt Lake City	NA	NA	22	59	1976	NA	19	NA	40
Washington	Seattle	NA	NA	20	55	1976	NA	25	NA	30
	Spokane	NA	NA	18	50	1976	NA	28	NA	22

Notes:

[a] Based on information in State implementation plans.

[b] Eight-hour average.

[c] At end of extension period.

[d] Not applicable.

[e] Including Maryland and Virginia suburbs.

EPA determined that the remaining 24 regions would need additional time beyond 1975 to achieve the air quality standards. Table 14 shows the time extensions these areas were granted to achieve the standards, the additional emission reductions provided by existing emissions control programs during the extension periods, and the emissions reductions required through transportation controls. The granting of time extensions was based upon implementation of all available measures as expeditiously as practicable. Even with these extensions, which in most cases are to 1977, emissions reductions of 7 to 53 percent are required. The emissions reductions at the high end of this range represent vehicle miles of travel (VMT) reductions of 50 to over 90 percent.

In total, 29 metropolitan areas now have transportation control plans.* At present, it appears likely that at least 10 of these areas will not achieve the air quality standards by 1977 through the implementation of reasonably available emissions controls. These areas include Los Angeles, San Francisco, San Diego, Fresno, Sacramento, Baltimore, Newark, Houston, Denver, and Fairbanks. The transportation control plans for all of these areas except Fairbanks include gasoline rationing that will take effect in 1977 if legally required to achieve the air quality standards (see Section 3). However, EPA does not consider gasoline rationing to be a reasonable or desirable approach to emissions reduction. Therefore, in March, 1973 EPA submitted to Congress a proposed amendment to the Clean Air Act that would avoid the need for gasoline rationing by providing additional flexibility in the setting of target dates for achieving the transportation related air quality standards (see Appendix C).

Recent air quality data indicate that certain areas which were not required to submit transportation control plans in 1973 may need to do so in the future. This is particularly true in areas that have recently begun to collect reliable air quality data for the first time and in areas that have unusually high VMT growth rates. In addition, recent air quality data gathered from many of the areas that have transportation control plans indicate that air quality has not improved since the time of the development of the plans. In several of these areas pollutant concentrations higher than those used in developing the transportation control plans have been recorded. For example, during 1974, Chicago, Dallas, and Denver recorded new, high oxidant readings as did Baltimore and Washington, D. C. during 1973. Air quality monitoring conducted in Boston from 1971 through 1974 has shown that the number of days per year the national standards for carbon monoxide are exceeded has grown in frequency. The recorded concentrations have increased as well. Though some of these recorded readings may be the result of a more extensive and effective monitoring system rather than deteriorating air quality, the newly recorded high concentrations reaffirm the need for transportation plans.

3. Transportation Control Measures to Reduce Auto Use

The principal approaches to reducing auto use that are employed in the transportation control plans are discussed in Chapter 3. This section describes the specific auto use reduction measures considered by the States, localities, and EPA in developing transportation control plans. None of the measures described here is included in all transportation plans. The process through which the States, localities and, where necessary, EPA selected measures for the inclusion in specific plans is described in Section 4.

As indicated in Chapter 3, the auto-use and emissions reductions achieved by transportation controls derive from the effects of the entire group of measures included in a transportation control plan, rather than the effects of individual measures. Moreover, the effectiveness of specific auto-use reduction approaches is strongly dependent on local conditions. Thus, no attempt has been made here to quantify the auto-use or emissions reduction effectiveness of individual transportation control measures.

a. Bus and Carpool Priority Treatment

Priority treatment for buses and carpools consists of allocating highway facilities preferentially to these vehicles for the purpose of increasing their average speeds. The usefulness of bus priority treatment in attracting auto drivers to transit is dependent on the quality of the transit system or subsystem that uses priority treatment. Hence, in areas where bus priority treatment is included in a transportation control plan, the measure is a part of an integrated transit improvement program. For example, in the Washington, D. C. area, priority treatment is used in combination with bus fleet expansion, the addition of new transit routes, and improved bus scheduling.

b. Carpooling Programs

Many transportation control plans include measures that provide computerized carpool matching programs and preferential carpool treatment programs. The matching programs provide for the formation of carpools, and the preferential treatment programs provide incentives such as free parking to encourage carpools.

Computerized carpool locator programs have been established in cities such as Washington, D. C. in cooperation with the Council of Governments; Boston, Massachusetts; Knoxville, Tennessee, and Omaha, Nebraska. Knoxville and Omaha have no existing requirements for transportation controls.

c. Employer Transit Incentive Regulations

Employer transit incentive regulations require employers who have facilities with large parking facilities (a minimum of 200-700 spaces) to submit a plan which encourages the use of carpools and mass transit, while at the same time discouraging the use of single-passenger automobiles for work related commuting. Under this approach, the employer has the flexibility to develop his own plan to minimize the impact of his facility on the area's vehicle miles traveled. The concept is based on already existing programs which have been developed by employers to discourage energy inefficient commuting habits. In addition, many employers have voluntarily started such programs to avoid the acquisition of land for additional parking facilities.

Companies such as Minnesota Mining and Manufacturing, and Aerospace Corporation of El Segundo, California have already illustrated the effectiveness of this approach in reducing commuter auto usage. Realizing the high costs of expanding their current parking facilities and the need to conserve energy, the Minnesota

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*These 29 areas are contained in 27 AQCR's. The New York City and Philadelphia AQCR's each contain two metropolitan areas.

Mining and Manufacturing Company has initiated a vanpooling program. The company has already purchased 67 vans and intends to expand the fleet to 200 vans which will serve some 2,400 employees. The program is currently eliminating the need for 1.5 million miles of travel a year and annually saves an estimated 120,000 gallons of gasoline. Through vanpooling and the company's carpooling program, about 40 percent of the 3M employees engage in some form of ride sharing. The program pays for itself through monthly vanpool passenger fees of $19 to $29. Furthermore, people like the program. Of the vanpool commuters, 41 percent used to drive to work alone and 95 percent find the program more convenient than the private auto.

The Aerospace Corporation in El Segundo, California has formulated an extensive employee carpool and charter bus program. This program includes both the employees of the Aerospace facility and the employees of a neighboring Air Force facility. The carpooling program alone reduces VMT by 4.55 million miles a year which is equivalent to 13 percent of the total VMT generated by employees at the two facilities. This involves a savings of 300,000 gallons of gasoline annually and a reduction of 50 tons of pollutants. In addition, over 250,000 gallons of gasoline are saved annually by the charter bus program.

d. Parking Programs

Parking regulatory programs are used in several transportation control plans to complement the improvement of mass transportation and carpooling alternatives. The transportation plans include two general types of parking regulations: on-street parking controls and parking management programs. The on-street parking controls are similar to common regulations in various cities to prevent congestion and to discourage commuter parking on public streets. In most cases, the on-street parking regulations are part of a locally developed approved plan as suggested by local officials for promulgation in an EPA plan.

Parking management regulations are required both to assure that new parking facilities, usually having 250 or more spaces, do not cause a localized carbon monoxide problem around the facility, and to minimize the effects new parking facilities will have on an area's vehicle miles traveled. The parking management program requires the owner or operator of a proposed new parking facility to obtain an air quality permit prior to construction of his new facility. The permit can be obtained by demonstrating that the new facility will not cause or exacerbate a violation of the national ambient air quality standard and that either the facility will not cause an increase in vehicle miles traveled or that efforts have been made to minimize the facility's effect on VMT. These efforts would be similar to those made by existing employers under the employer incentive plan. Minimization measures would include the commitment to assure that alternative transit forms such as carpooling and mass transit will be available at the new facility.

Under the parking management regulations the States are encouraged to develop their own area-wide parking facility plans to replace the Federal regulations. These plans would focus on the inter-relationship of transportation alternatives and new parking facilities. The plans would set forth the manner in which the location, operation and increase in the number of parking related facilities are to be kept consistent with air quality needs throughout the area. The plans could also assure that the new facilities complemented rather than competed with existing and developing transit facilities. London already uses parking restrictions as a traffic control approach (see Chapter 3), and several areas such as San Diego, Los Angeles, Portland, and Seattle have begun such plans.

e. Transit Expansion and Improvement

The improvement and expansion of mass transit facilities is one of the key elements for the success of transportation plans. Bus fleet expansion will allow service to be upgraded in several major respects:

- Existing routes can offer more frequent service
- New routes can be established which allow more people the opportunity of transit
- Older uncomfortable vehicles can be replaced with smoother riding, air-conditioned vehicles.

Many areas have established within the last 2 years programs to improve and upgrade existing transit systems. Therefore, in the near future many areas will begin to offer the type of alternative transit which is required to help achieve the required VMT reductions. An example of the type of improvement which can effect a reduction in VMT is the Seattle "Magic Carpet" program. City wide fare reductions along with free fares within the CBD were associated with a fleet expansion and exclusive bus lanes. The increased ridership will help Seattle achieve the VMT reductions necessary to achieve the National Ambient Air Quality Standards.

In the development of the transportation control plans, EPA took into account the local plans for the upgrading of mass transit and included these plans in the projections of VMT into future years. Thus, many areas were given air quality credit for the programs they have established. EPA specifically approved transit plans as part of the transportation control plans in three areas (Washington, D. C., Baltimore, Seattle) where local officials had made firm commitments for fleet expansions. In other areas EPA did not approve nor disapprove the measure but, instead, projected the improvements into future VMT predictions. If the system expansion plans do not materialize, appropriate plan modifications must be made in future years.

Sufficient Federal funding is necessary if these areas are to expand transit to the level necessary to provide assistance in achieving the VMT reduction goals contained in the plans. EPA has been working with DOT to assure the availability of such funding (see Chapter 6). In addition, States and localities must be willing to increase their support for mass transit. Ideas such as using sales tax revenues for capital and operating expenses and therefore stabilizing fares have been successfully implemented in Atlanta. Other areas must continue to provide the necessary local commitment if expanded mass transit is to become a reality.

f. Parking Surcharge and Parking Fees

Several of the EPA promulgated plans called for the implementation of surcharges or commercial rates on parking. The use of such fees both discourages non-carpool automobile commuting and provides a source of financing for transit improvements (see Chapters 3 and 5). The measure can help bring about a significant change in urban driving habits with a minimum of social disruption if the fees are properly formulated and integrated with transit improvements. The program provides a wide latitude of individual choice to the driver. Those whose needs or preferences are strongly in favor of using the single passenger automobile may continue to do so, although at a somewhat higher cost; those who can easily adopt to other modes of transit or a carpool will have an incentive to take such action.

The use of parking surcharges was limited to three parts of the country in the transportation control plans: Washington, D. C., Boston, Massachusetts, and five metropolitan areas in California (Los Angeles, San Diego, San Francisco, Fresno, and Sacramento). In the Washington area, the surcharge measure was formulated by the Council of Governments and the local jurisdictions. The measure was incorporated by the Council of Governments into an area wide transportation plan which included bus lanes, mass transit improvements, carpooling programs, bikeways and general parking regulations. The surcharge portion of the plan was reasonably formulated to cover areas adequately served by mass transit and was generally viewed as a sound strategy. The plan was submitted to EPA for approval and was partially approved. Though the plan set forth adequate commitment for the local implementation of the surcharge in the private sector, it called upon the Federal Government to place it on the Federal facilities in the D. C. area. EPA thus promulgated the charge according to the plan's scheme for Federal facilities.

In Boston, the surcharge proposal was also formulated by the State and local officials. Since the State could not submit a plan officially to EPA in the short time available, the community representatives worked with EPA on the details of the plan. The surcharge measure for Boston was limited to areas with adequate transit service. After being proposed and modified by public hearings, the surcharge was promulgated as a part of the Boston plan.

The surcharge measure also was discussed at public meetings on the plans for the various cities in California. However, the idea was not fully developed at the local level. EPA promulgated the surcharge in the five cities without having adequately analyzed how it should be applied in California. Consequently, the promulgation misapplied the surcharge measure to the California cities. The fee was applied to both small and large sources over an area which was not adequately served by mass transportation. The adverse reaction to the surcharge in the California cities was thus well-founded. However, a more judicious application of surcharge strategy in these West Coast cities could have been beneficial.

EPA had concluded at the time of plan promulgation that the statute provided the necessary authority to require a surcharge. However, after Congress expressed its intent to prohibit EPA from promulgating parking charges in the Conference Committee's draft report on the Emergency Energy Act, the Administrator took action to remove the measures from the affected plans on January 15, 1974. (39 F.R. 1848, January 13, 1974). The parking fee prohibition language was included in the final Energy Supply and Environmental Coordination Act of 1974. The statute still gives EPA the authority to approve a State implementation plan which contains a surcharge measure.

g. Gasoline Supply Limitations

Gasoline limitations are, at least in theory, one of the most effective methods of reducing VMT.

At the time the transportation control plans were first proposed, gasoline supply limitations were proposed to be included in several plans. Two types of regulations were proposed:

- A gasoline supply lid that would have become effective during 1974 or 1975 which would have limited the quantity of gasoline sold in an area to fiscal 1973 levels;
- A regulation which would be implemented on May 31, 1977 to reduce an area's gasoline supply and thus VMT, to the extent necessary to achieve the ambient air quality standards.

The gasoline supply lid was dropped as a primary control measure by EPA at the time the plans were finally promulgated. The determination not to include gasoline supply lids as "reasonably available" was based upon the comments received during the public hearings held on each plan and the Agency's evaluation of the feasibility of implementing and administering an effective program. Moreover, possibilities of evasion, the likelihood of noncompliance, and the difficulty of enforcement appeared too great to make this measure practicable.

The gasoline supply reduction regulation to be implemented on May 31, 1977, however, has been retained in plans for several areas. In these areas, this measure was included as a final resort measure to fulfill the statutory requirement that a plan must achieve the ambient air quality standards by 1977. In each of these areas, even with the FMVCP, additional stationary source controls, inspection/maintenance programs, reasonable VMT control measures, and retrofit strategies, additional VMT reductions were necessary to demonstrate attainment of the standards. As the Administrator has stated on several occasions, this measure has been included in these plans to meet the technical requirements of the law and the Agency does not intend to implement this measure unless it is legally required to do so. EPA has submitted a proposed amendment to the Clean Air Act which would allow additional flexibility in these heavily impacted areas (see Appendix C).

h. Additional VMT Reduction Measures

Several other measures were considered and accepted or rejected for use in transportation control plans. Measures used by the States or EPA to a limited extent include bicycle lane programs and vehicle-free zones. Some of the approaches which have been considered and not implemented include selective vehicle exclusion strategies and gasoline truck delivery bans.

Bicycle Lanes

America is experiencing an unprecedented boom in bicycle sales and usage. In 1973 15.3 million bicycles were sold (Ref. 1). Studies submitted as technical support for transportation plans have indicated that increased use of bicycles in urban, short-distance commuting could assist in reducing VMT (Ref. 2, 3). Public comments during the course of the plan development also favored the increased use of bicycles in many areas.

An extensive bicycle lane program now underway in Denver, Colorado has met with much popular support and a vast increase in commuting bicycle riders. At present, the major obstacles to cycling are high accident rates, high bicycle theft rates, increased exposure to auto pollutants, and insufficient support facilities. The last problem tends to cause the previous three, and all of them could therefore be greatly alleviated by providing segregated bikeways and adequate support facilities. The EPA approved or promulgated bicycle lane programs generally provide for both physical separation and adequate storage facilities.

Vehicle Free Zones

Traffic free zones are primarily used to control local carbon monoxide problems. The zones are necessarily restricted in size (approximately ten blocks or less) in order to provide foot access. Vehicle free zones are being included in plans for Springfield, Massachusetts, the Camden-Trenton area of New Jersey, and Salt Lake City, Utah to reduce carbon monoxide concentrations.

Selected Vehicle Use Prohibitions

In several regions, EPA proposed a regulation under which the vehicle population would have been divided into five categories. Each category of vehicles would have been required to display prominently a tag of a distinctive color: on one day of each working week vehicles marked with one such color would have been forbidden to operate.

Testimony at all the public hearings indicated that measures of this type would be unenforceable because of their severity and arbitrary nature. The number of additional enforcement personnel necessary to implement such a program would have been so great as to preclude the reasonable availability of this measure. If the measure were implemented, many methods of evasion would doubtless be devised. Consequently, use of the selective vehicle ban was rejected as a strategy.

Gasoline Truck Delivery Bans

The emissions from gasoline-powered trucks are regulated far less stringently than those from passenger cars. EPA and certain local governments considered imposing selective truck delivery bans as a strategy. This approach would be intended to reduce pollution both by removing congestion associated with truck deliveries during peak traffic periods and by reducing emissions from truck operations.

The degree of restriction on truck travel which is consistent with the maintenance of a healthy economy varies greatly from city to city. In most instances, the potential for economic disruption combined with the low contribution of trucks to total emissions caused EPA to reject such measures. However, in New Jersey the contribution of gasoline-powered trucks to overall air pollution problems is far more significant than in most areas. Therefore, EPA originally promulgated a heavy-duty delivery ban during the morning hours for the Northern New Jersey area. After receiving many comments concerning this measure from the public and affected industry, it was found that equivalent emissions reductions from gasoline-powered trucks could be achieved through a relatively inexpensive carburetor modification or replacement. Accordingly, EPA revoked the truck delivery ban and proposed the less socially disruptive truck engine modification measure.

4. Transportation Control Plan Development Process

a. Initial State Submissions

The Clean Air Act assigns to States and the affected cities primary responsibility for developing implementation plans to achieve the ambient air quality standards. By law, EPA promulgates an implementation plan or portion of a plan only if a State fails to submit an approvable plan by the legally established deadline. In the case of the transportation portions of implementation plans, the deadline was April 15, 1973.

To assist States in the development of transportation control plans, EPA financed contractors to work with the affected areas to gather data and help draft the required plans. The contractors generally completed their activities in early 1973.

In most cases, the States took few actions beyond the stage of technical cooperation with the contractors during the period of contractor activity. Since transportation control plans had to be proposed, submitted to a public hearing and comment process, reevaluated, and approved by various levels of State government prior to submission to EPA for approval, the majority of affected States were far from a plan submission stage by early 1973. This situation was further complicated by the court order in the *NRDC* case, which required submission of plans by additional States that had previously relied solely on the FMVCP for standard attainment. Consequently, few transportation control plans were ready for submission to EPA by the court established April 15 deadline.

By June 15, 1973, only 16 States had submitted plans to EPA for approval. Most of these plans were entirely disapproved or found to be partially inadequate. Most of the approved plans required few transportation control measures, since they demonstrated that stationary source controls combined with the new car emission control program would provide for standard achievement by 1975. However, a stringent and approvable transportation plan was submitted for New York City. This plan was the first major State developed transportation control plan approved in its entirety.

EPA was legally required to propose transportation controls on June 15, 1973 for areas that had submitted inadequate plans of their own or no plans. Both before and after the June 15 proposals were made, EPA worked with State and local officials to encourage them to formulate transportation control approaches that could replace or be included among the EPA-proposed measures. EPA accepted the approvable portions of inadequate plans and proposed only additional measures that complemented the approved portions. In many cases, the EPA proposals employed the same approaches that were submitted by the States but not approved due to technical or legal omissions.

Plan development activity in the Washington, D.C. area provides an example of this process. The plan for the metropolitan Washington, D.C. was developed by the Metropolitan Washington Council of Governments during the 18 months preceeding the April submission date. During April of 1973, the three affected jurisdictions (Washington, D.C., Virginia, and Maryland) submitted complementary plans for the National Capital area which were partially approved. The EPA proposed measures for the disapproved portions of the Washington area plans followed the structure of the submitted plans. The Agency continued to work with the Council of Governments and representatives of the various jurisdictions to finish a new plan submission for the disapproved portions. In late July of 1973, the area governments submitted plan revisions. These revisions were for the most part approved and replaced some of the proposed regulations. Consequently, the regulations which were promulgated by EPA covered only certain remaining inadequate portions of the existing State plans. Since the promulgation, the local jurisdictions have developed additional revisions to replace most of the EPA regulations.

The proposal of total plans for other areas, such as Portland, Oregon and Minneapolis, Minnesota was followed by total approval of plans subsequently submitted by the States. These plan approvals negated the need for Federal promulgation actions. An inadequate plan for Denver, Colorado was originally submitted and disapproved. Following EPA's proposal of measures for Denver, the State of Colorado submitted approvable plan revisions which replaced all transportation related measures in the EPA proposed plan. In many other cases, local plan development continued past the time of EPA's proposal actions and completely or partially removed the need for EPA to promulgate measures for those areas.

As a result of this emphasis on local participation, plans for 17 of the original 39 areas needing transportation controls have been totally or partially approved.

b. EPA Promulgations

In the remaining cases, EPA was required to promulgate entire transportation control plans. The procedures followed by EPA included solicitation of public comment and the holding of public hearings in the affected areas. The proposed plans were modified in a large number of cases as a result of information acquired during the comment and hearing process.

EPA used the following priorities in considering transportation control measures for inclusion in promulgated plans (although there were certain exceptions as noted below):

- Additional stationary source control
- Inspection/maintenance
- VMT reduction measures
- Retrofit
- Gasoline supply limitations

These priorities generally move from the most acceptable to least acceptable control measures. Additional stationary source regulations on certain industrial processes such as solvent usage or dry cleaning and on evaporation of vapors during gasoline marketing processes are considered traditional pollution control approaches. Thus EPA included these controls initially in plans before considering additional transportation measures.

Inspection/maintenance is the next most acceptable alternative. Inspection/maintenance assures that emission control devices placed on new motor vehicles will continue to be maintained over the vehicles' lifetimes. The program can provide significant emission reductions; it can be easily financed by vehicle registration fees, and it has a precedent in safety inspection programs.

When VMT reductions were required, initial consideration was given to priority treatment for high occupancy vehicles, transit improvements, carpool programs, and employer incentive regulations. If more emissions control was required, additional VMT reduction measures or retrofits were applied. The other VMT reduction measures included on-street parking limitations, parking management plans, and surcharge regulations. The retrofit measures called for the placing of additional controls on in-use vehicles. Although retrofit controls placed an economic burden directly on the vehicle owner, they were preferred in areas such as Phoenix, Arizona over the use of some of the more stringent regulations designed to reduce vehicle miles traveled.

Catalytic converter retrofits and gasoline supply limitations were only used as last resort for especially severe air pollution problems. Despite the potential effectiveness of catalytic control retrofits on newer model in-use vehicles, the high cost and technical problems associated with these devices discouraged their inclusion in control plans if other options were available. Gasoline limitations, which are to be applied in mid-1977, were included only as a last resort. EPA's policy on gasoline limitations is discussed in Section 3 of this chapter.

c. Selection Factors for VMT Measures

The factors considered in selecting VMT reduction measures for EPA promulgated plans included:

- The VMT reduction capabilities of measures and combinations of measures
- The enforceability and legal defensibility of measures
- Previous experience with measures
- The pollutants being controlled
- The quality of existing or planned transit service in communities
- The economic and social disruption associated with measures

The VMT reductions achieved through transportation controls derive from the effects of the entire group of measures included in a transportation plan, rather than the effects of any single measure. Hence, during plan development emphasis was placed on the effects that combinations of complementary measures would have on automobile use in an area. An attempt was made to assure that a variety of measures, such as transit improvements, carpool programs, bicycle lane programs, and employer transit incentive programs would be implemented. Measures to discourage single occupancy vehicle use were included in many plans to complement the transit improvement measures. These measures included on-street parking limitations, free parking for carpools, parking management programs, and parking surcharges.

Another major factor considered in the selection of control measures was the legal defensibility of the measures and their enforceability. Many of the measures included in the transportation control plans call for action affecting the operation of streets and roads (e.g., exclusive buslanes, bicycle lanes, and restrictions on on-street parking). When EPA promulgated these measures, the resulting regulations require State or local governments to implement the measures. This approach is based upon two premises:

- That governmental units must abide by valid implementation plan requirements just as any other source is required to comply
- That governments are the owners and operators of pollution sources through their ownership and operation of the streets and highways.

This position is analogous to holding a local government responsible for sewage collection and treatment rather than each individual citizen and has been upheld by the Third Circuit Court of Appeals in *Commonwealth of Pennsylvania v. EPA*, 500 F.2d246.

Control strategies such as employer mass transit and carpool incentive programs, parking management, and off-street parking space reductions involve limitations of off-street parking and require actions on the part of owners or operators of particular facilities. (The relationship of parking supply to automobile use and emissions is discussed in Chapter 3). EPA does not assert the right to compel State or local governments to regulate off-street parking, although they may regulate it if they wish as part of an implementation plan. In *South Terminal Corporation v. EPA*, 6 ERC 2025 (C.A. 1, 1974), the court upheld EPA's authority to control parking facilities and the principles behind the VMT control measures promulgated in the Boston area by EPA.

The question of EPA's authority to promulgate parking surcharges has become moot due to the explicit Congressional prohibition on such EPA promulgation contained in the Energy Supply and Environmental Coordination Act of 1974, P.L. 93-319, 88 Stat. 246 (June 22, 1974). However, at the time EPA promulgated this measure, the question had been extensively examined with the conclusion that such a measure probably could be upheld.

A third factor EPA considered in selecting VMT reduction measures was the past experience with a particular measure. Most of the measures promulgated have previously been used or proposed to alleviate transportation problems other than air quality. Bus lanes, for example, have been widely examined and utilized as a mass transportation improvement measure during recent years (see Chapter 3). The employer transportation incentive program is based on existing programs set up by private employers to conserve energy or avoid the costs of additional parking facilities.

The air pollutants requiring control can vary between areas requiring transportation controls and influenced the selection of VMT reduction measures for a particular area. For example, if carbon monoxide is a major problem in the core area of a city, measures such as parking restrictions in the affected central city area might be appropriate. On the other hand, in the case of region-wide oxidant control, measures such as employer transit incentive programs, which result in area-wide VMT reductions, are needed.

Another consideration involved in the selection of measures was the existing transit programs and plans of the affected communities. In Dallas, Texas, for example, local government officials had been considering the use of bus lanes to aid the local transit system. Realizing these existing plans, EPA promulgated bus lane related strategies for the Dallas-Fort Worth region.

The incorporation of an on-street mall in Salt Lake City was suggested by city officials at hearings held by EPA, since such a concept was a part of the on-going program to reduce downtown congestion.

The plan submitted by the State of Washington for Seattle contained a proposal for a carpool matching strategy. EPA was forced to disapprove this strategy due to the lack of an enforceable commitment to the program and the lack of administrative details. However, in view of the continued show of support for this measure at public hearings and in correspondence from city officials, EPA promulgated the program as part of the transportation control plan. Whenever possible, EPA attempted either to use previously developed local plans which would contribute to VMT reductions or to promulgate measures for which public support was evident.

Finally, EPA considered the potential economic and social disruption associated with control measures. Efforts were made to insure that transit or carpools would be capable of carrying the automobile trips displaced by transportation control measures. For example, the parking surcharge regulation originally promulgated and now withdrawn for the Washington, D.C. area was structured to affect only peak period work trips to locations well-served by transit. Moreover, the surcharge was to be increased gradually over a period of several years as transit service improved.

5. Status of Transportation Control Plans

Appendix A lists each VMT control measure promulgated or approved by EPA, and summarizes status of each of these measures. This listing includes only areas where VMT control strategies were included in transportation control plans. Therefore, areas such as Indianapolis and Cincinnati, whose plans have no VMT reduction measures, are not included in Appendix A.

Bus priority treatment is included in thirteen plans; bicycle lanes are included in eight plans; parking management is included in nineteen plans; carpool matching programs are included in eighteen plans; and on-street parking restrictions are included in eight plans. Parking surcharges and parking fees were included in plans for five areas. However, after Congress expressed its intent to prohibit the EPA from promulgating parking surcharges, the EPA rescinded this measure in each of the plans where it was promulgated on January 15, 1974 (39 FR 1848). Employer mass transit and carpool incentive progams were a part of plans in fifteen areas. In three areas in California, in the Washington, D.C. area and New Jersey, this measure consisted primarily of charges for employee parking. These, too, were rescinded by the Administrator in his January 15, 1974, action. In the areas where the employer mass transit and carpool incentive program did not contain a requirement for parking charges, the provision remains in effect. In New Jersey, a new regulation covering employer incentive program was proposed and promulgated.

In those areas where parking surcharges and fees were rescinded by the Administrator, substantial gaps have been created. For example, in Boston the parking surcharge and other parking fees accounted for approximately 5 percent of the required carbon monoxide reductions in the core area and approximately 10 percent of the carbon monoxide reductions in the east Boston area. This reduction is greater than the reduction achieved by retrofitting pre-1968 vehicles with VSAD devices and 1974 vehicles with oxidizing catalyst retrofits. In terms of hydrocarbon emissions reductions, the surcharge and parking fees are roughly equivalent to the VSAD and catalytic retrofit measures. In the Washington, D.C. area, the parking surcharge and parking fees represented emissions reductions greater than the combined total reductions achieved through VSAD retrofit of pre-1968 vehicles, catalytic retrofit of fleet vehicles, and retrofit of heavy-duty vehicles.

Although compliance with the transportation control regulations is spotty and not nearly complete, substantial progress is being made. Exclusive buslanes are progressing toward implementation in many areas. For example, pilot lanes have been established in Seattle, Los Angeles, Denver, the New Jersey suburbs of New York City, and the Washington, D.C. area. In Pennsylvania studies are underway to determine the best route locations. In general, funding for the construction or conversion of these exclusive lanes is available under the current highway legislation.

Transit fleet expansions and system improvements are being undertaken in many transportation control areas. However, as was discussed in Section 3 of this chapter, EPA approved this measure only when it was specifically proposed by a State and did not promulgate it. In areas such as Washington, D.C. and Baltimore, the progress toward fulfilling the goals set out in the plans has been substantial. However, to fulfill the need for expanded bus fleets in cities such as New York, Los Angeles, Seattle, Philadelphia and Denver, additional Federal and State funding must be made available to finance the costs of fleet expansions and other system improvements.

On-street parking restrictions have recently been established in Arlington, Virginia and are under development in Washington, D.C. Other areas are beginning to implement this program on a pilot basis. Carpool matching programs have been especially successful, often as a result of the gasoline shortage of early 1974. Most of these programs are in the pilot phase but are scheduled to progress in a timely manner toward full implementation.

The parking management regulations promulgated during November and December of 1973, which met initial resistance, have had amendments proposed on August 22, 1974 (39 FR 30440) which add flexibility and encourage local participation. Several areas are actively pursuing the development of comprehensive parking management plans. These areas include Los Angeles, San Diego and San Francisco. The State of Washington has recently adopted an indirect source regulation which includes parking management review in Seattle and Spokane. The State of Oregon is currently reviewing new parking facilities in the Portland area.

The employer mass transit and carpool incentive programs also are progressing. Many substantial, effective plans have been submitted in areas such as Boston, the New Jersey suburbs of New York, Phoenix, Baltimore, Houston, and Pittsburgh.

There have been problems encountered in the implementation of many measures. For example, several parties have challenged EPA's authority to require an employer to submit a mass transit and carpool incentive program. The only court to rule on this issue has decided this issue in EPA's favor. *South Terminal Corporation v. EPA*, 6 ERC 2025 (C.A. 1, 1974). Some employers subject to employer incentive regulations have submitted inadequate plans, and some others have not made a submittal.

In Texas, pursuant to the order of the Fifth Circuit Court of Appeals in *State of Texas, et al., v. EPA*, 499 F.2d 289, all VMT related control strategies have been deferred pending reconsideration of the reactivity of hydrocarbon emissions from refineries. In Massachusetts pursuant to the *South Terminal* case, implementation of several parking controls was suspended pending reexamination of air quality data.

In areas such as Philadelphia and its New Jersey suburbs, jurisdictional problems have caused difficulties in implementing exclusive buslanes. Similar problems are being encountered in several other areas where more than one political entity is involved.

6. Indirect Source Review

An indirect source is a facility that may attract automobile traffic sufficient to cause violations of the ambient air quality standards in the vicinity of the source. Examples of indirect sources include shopping centers, office buildings, sports stadia, highways, and airports.

Regulations for indirect source review (ISR) will require the developer of a proposed indirect source to obtain a permit prior to construction from EPA or, in many cases, from State or local agencies administering their own or EPA's indirect source program. A permit will be issued unless it is found that the construction of a source will violate the ambient air quality standards.

As is more fully explained in Appendix B, EPA has determined that State implementation plans must include indirect source regulations in order to assure continued maintenance of the ambient air quality standards. Despite the beneficial effects of new car emissions controls, stationary source controls, and transportation controls, new indirect sources having sufficient trip-inducing capacity may attract sufficient traffic to cause localized violations of the ambient air quality standards, particularly the carbon monoxide standards. Since, by law, implementation plans must assure that this does not happen, there must be a mechanism to review proposed new indirect sources prior to their construction and to assure that such sources will be constructed in a manner that does not lead to violation of the air quality standards. ISR provides this mechanism.

Although the basic concept of indirect source review is straight-forward, there are certain technical problems involved in determining whether a proposed indirect source actually will cause a violation of the air quality standards. In the case of nitrogen dioxide and oxidants, it is difficult to prove that a specific indirect source the size of most real estate developments will cause (or has caused) a specific air pollutant concentration. This is because individual sources emit only the precursors of these pollutants. It may be several hours and many miles downwind before the pollutants emitted at an indirect source react in the atmosphere to form nitrogen dioxide and oxidants. However, in the case of carbon monoxide, which is relatively unreactive and is emitted directly from mobile sources, there is clear evidence that the traffic in the vicinity of indirect sources can threaten or violate the air quality standards for carbon monoxide (Ref. 4, 5, 6). Hence, present ISR regulations focus mainly on localized carbon monoxide air quality problems.

EPA strongly encourages States to develop their own ISR programs and submit them to EPA for approval. However, EPA will promulgate ISR regulations for States that do not submit approvable ISR programs of their own. In developing a Federal ISR regulation, EPA focused on major facilities that could have a significant effect on air quality. In the case of new real estate developments, the criterion for determining whether a facility is subject to review is based on parking lot size (i.e., new parking capacity of at least 1000 cars in SMSA's and 2000 cars elsewhere). This does not mean that facilities with lots greater than 1000 spaces cannot be built, but that such facilities must be evaluated for their effects on local carbon monoxide concentrations. Moreover, ISR makes no presumptions about which facilities will cause violations of the carbon monoxide standard. Rather, it is a review regulation that requires a specific finding supported by technical evidence that the standard would be violated by a certain facility before that facility's permit to construct may be denied.

EPA expects that by using improved traffic flow design or incorporating certain transit options into facility operations, most facilities subject to ISR will satisfy the requirements for issuance of a permit. The types of design options likely satisfy air quality requirements are frequently incorporated in facility design already and normally are consistent with achieving other desirable effects such as smooth traffic flow in and around the proposed facility.

EPA has published and distributed technical guidelines that frequently will be used by the Agency for making its decisions on requests for ISR permits (Ref. 7). These guidelines contain a simplified methodology for relating key traffic characteristics to localized carbon monoxide concentrations and should be useful to developers in designing their facilities. The guidelines also include a discussion of several approaches to improving traffic flow characteristics and, thus, minimizing a facility's potential for causing a violation of the carbon monoxide standard. Moreover, the guidelines translate the required air quality determination into specific performance criteria with which developers are much more familiar.

EPA strongly encourages State or local governments to assume the responsibility for making ISR decisions, operating under either EPA approved State or local regulations or as EPA's agent. EPA staff have met on numerous occasions with State and local agencies, the National Association of Counties, the League of Cities, the Governors' Conference, the National Association of Regional Councils and other similar groups to encourage local participation in ISR, explain EPA's position and obtain the various groups' views. In developing its own regulation, EPA has had meetings and discussions with a wide variety of industry and public interest groups including the International Council of Shopping Centers, National Association of Realtors, the National Realty Committee, and the Natural Resources Defense Council.

EPA has developed an ISR application form (approved by OMB) and has made this available, together with the previously discussed technical guidelines, at each EPA regional office. As of November 12, 1974, five applications have been received by EPA regional offices. One application was made available for public comment on October 30, 1974 after a preliminary determination of acceptability. The other applications are undergoing review for their completeness and/or preliminary determination of acceptability at the time of writing.

Although the EPA-promulgated ISR regulations do not require review of facilities unless construction begins on or after January 1, 1975, several States already have begun to implement indirect source regulations of their own. EPA has the approved ISR regulations submitted by Alabama, Florida, Guam, Kentucky, and North Carolina. The approved ISR regulations will operate in place of EPA's regulations in these jurisdictions. State-submitted ISR regulations of Maine, New York, and Virginia have been disapproved. EPA is continuing to assist these and all other States to develp approvable regulations. Thirteen additional States have submitted ISR regulations for EPA approval or plan to submit regulations soon.

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chapter 5 - economic and social effects of reductions in auto use

1. Introduction

The implementation of measures to reduce automobile emissions by reducing automobile use will affect many aspects of urban activity other than air quality. Many of these non-air quality effects of transportation controls are beneficial and would make the implementtion of the control measures desirable even if air quality were not a problem. For example, diversion of auto drivers to transit and carpools is likely to reduce congestion, energy consumption, and urban traffic safety problems. Indeed, the transportation measures that have been proposed to improve air quality have also been proposed to alleviate non-air quality related urban transportation problems. However, some of the effects of reduced auto use will not be beneficial. For example, it is unlikely that transit or carpool travel times can equal auto travel times under uncongested conditions and over widespread areas. Thus, reductions in auto use through diversions of auto drivers to other modes can be expected to increase average travel times. Moreover, the well-being of certain economic groups (e.g., parking lot operators) is dependent on high levels of auto use. These groups are unlikely to benefit from reductions in auto travel.

This chapter describes the potential effects of reductions in auto use on the following aspects of urban activity:

- Energy consumption
- Noise
- Traffic safety
- Traffic congestion and the need for additional highway construction
- Travel times
- The costs of transportation

In addition, the effects of parking restrictions and surcharges on individual mobility and business activity are discussed.

The estimates of economic and social effects presented in this chapter are tentative and should be interpreted with caution. There has been little direct experience with many transportation control measures or with changes in transportation system attributes of the magnitudes contemplated in some transportation control plans. Thus, the empirical basis for projecting the economic and social effects of transportation controls is weak. Certain types of effects are particularly difficult to forecast. Changes in urban land use are in this category. These empirical difficulties are not unique to air-quality-related transportation controls. The same problems are present in attempts to forecast the economic and social effects of any substantial changes in urban transportation systems. Moreover, these problems will persist until the implementation of the proposed changes, at least on a trial or demonstration basis, provides opportunities for direct observation of the effects of the changes.

Another source of difficulty in generalizing about the economic and social effects of transportation controls is that these effects are highly dependent on the specific control measures implemented, the manner in which they are implemented, and the area in which they are implemented. In addition, the effects of any single transportation measure depend on the characteristics and timing of all other measures that may be implemented. For example, transit fare reductions implemented by themselves are likely to have considerably different effects than fare reductions combined with substantial transit improvements.

The material presented in this chapter is derived from data on the characteristics of alternative urban transportation modes and from empirically-based studies of the observed or projected effects of transportation system changes that reduce (or would reduce) auto use in several U.S. and European cities. The resulting quantitative estimates of the potential economic and social effects of auto use reduction illustrate the likely directions of these effects. Of course, none of the estimates is quantitatively precise, and none is fully applicable to every transportation plan in every area. All of the estimates could be improved greatly through direct observation of the effects of implemented transportation controls.

2. Case Studies

Much of the material presented in this chapter is based on five case studies of the effects of transportation system changes in specific urban areas or portions of urban areas. This chapter also includes a summary of the results of a study of the effects of indirect source review. The objectives of these six studies are summarized in this section. The results of the studies are presented in the sections on specific economic and social effects.

a. I-66 Transportation Corridor Alternatives Study (Ref. 1)

This is the draft environmental impact statement for a proposed section of interstate highway I-66 in the Washington, D.C. area. It describes the projected environmental, social, and economic effects of five transportation options in the I-66 corridor. The year for which projections are made is 1995. In summary, the transportation options considered are:

- Base Case – Includes the existing highway system, highway improvements that are currently programmed, the 98-mile rail transit system (Metro) now under construction, feeder bus routes for the rail transit system, and certain express bus routes.
- Transit Option – Emphasizes mass public transportation through the addition of line haul transit and feeder bus service, improved or supplemental bus routings, and other transit elements which complement the Base Case.
- Highway Option – Includes I-66 and the elements contained in the Base Case.
- Multi-Mode/New Facility Option – Combines the elements of the Base Case, the Transit Option, and the Highway Option.
- Multi-Mode/Improvements to Existing Facilities Option – Includes the components of the Base Case and the Transit Option together with major improvements to certain existing streets and highways. Two suboptions were developed involving different approaches to improving existing highways. A portion of the proposed I-66 section

TABLE 15

VMT IN I-66 CORRIDOR BY TRANSPORTATION OPTION (1995)[a]

Option	Peak Hour VMT	Peak Hour %Change[b]	Daily Average VMT	Daily Average %Change[b]
Base	468,000	0	4,675,460	0
Transit	425,000	-9	4,250,981	-9
Highway	541,000	+16	5,405,279	+16
Multi-Mode/ New Facilities	490,000	+ 5	4,900,032	+ 5
Multi-Mode/ Existing Facilities				
1[c]	474,100	+ 2	4,744,391	+ 2
2[d]	481,000	+ 3	4,810,792	+ 3

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a. Source: Ref. 1
b. Relative to base case
c. Suboption 1
d. Suboption 2

would be constructed under Suboption 2.

Table 15 shows the effects of the various options on AM peak-hour and daily average VMT in the I-66 corridor. The Transit Option reduces VMT by 9 percent relative to the base case and by 22 percent relative to the Highway Option.

b. Evaluation of a Bus Transit System in a Selected Urban Area (Ref. 2)

The objective of this study was the investigation and evaluation of a bus transit system as a reasonably acceptable and economically competitive alternative to further highway construction in a metropolitan area. Using Baltimore, Maryland as an example case, the study designed a bus-transit oriented and an automobile-oriented transportation system for the purpose of alleviating peak-hour overloads on highways. The two systems were evaluated for the year 1980. Relative to the automobile-oriented system, the transit oriented system achieves a 6 percent reduction in peak-hour automobile person trips and a 1 percent reduction in off-peak automobile person trips.* Changes in VMT are not reported.

c. Shirley Highway Express-Bus-on-Freeway Demonstration Project—First Year Results (Ref. 3)

This study reports the results of the first 18 months of the Shirley Highway Project, which involves express bus service in a corridor connecting residential communities in Northern Virginia with employment centers in Washington, D.C. The bus service includes residential collection routes, park-and-ride facilities, and a busway along the Shirley Highway. The busway has resulted in roughly a 10 percent reduction in peak period automobile vehicle trips in the Shirley Highway corridor.

d. Pittsburgh Parking Strike (Ref. 4)

In August 1972 a three day strike by parking lot attendants closed roughly 80 percent of the parking spaces in downtown Pittsburgh, Pa. A retrospective study of the strike investigated, among other things, the effects of the strike on absentee rates, downtown sales, general effects on business, and opinions of employees and businessmen. The strike caused a 25 percent reduction of automobiles entering the central business district during the morning peak period. Roughly 75 percent of peak-period commuters to the central business district switched to transit.

e. San Diego Transportation Plan Analysis (Ref. 5)

This is a study of the effects of alternative transportation control plans to improve air quality in San Diego, California. The alternatives considered are:

- Base case – Currently programmed transportation system including 350 vehicle bus transit system.
- Alternative 1 – Currently programmed transportation system but with 550 vehicle transit system and parking surcharge of $0.25 per hour up to a daily maximum of $2.50.
- Alternative 2 – Same as Alternative 1 but without the parking surcharge.
- Alternative 3 – Currently programmed transportation system but with 875 vehicle transit system.
- Alternative 4 – Same as Alternative 1 except parking surcharge is $1.00 per day and applies only to work trips.
- Alternative 5 – Same as Alternative 3 but with $1.00 per day parking surcharge applied only to work trips.

The projected effects of the various alternatives on daily VMT in 1977 are shown in Table 16. The maximum VMT reduction relative to the Base Case achieved by any of the alternatives is 9 percent.

f. Economic and Land Use Effects of Indirect Source Review (Ref. 16)

The purpose of this study was to determine the potential economic and land use effects of EPA's indirect source review (ISR) regulations applicable to

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*An automobile person trip is a person trip by automobile.

TABLE 16

Effects of Transportation Alternatives on Daily VMT in San Diego (1977)[a]

	Base Case	Alternatives 1	2	3	4	5
VMT (Thousands)	18946	17249	18739	18526	18589	18318
Percent Reduction from Base Case	0	9	1	2	2	3

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a. Source: Ref. 5

new or modified real estate developments (see Chapter 4). The principal methodological approach used was simulation of the application of ISR to six developments selected as case studies. The case studies included two regional shopping centers, two office parks, and two mixed use (commercial and residential) complexes. The case study analysis was supplemented by interviews with State and local officials, developers, and representatives of financial institutions in Oregon, Florida, and Philadelphia. These areas were selected because they have had experience with ISR regulations similar to EPA's.

The following three ISR-related costs were analyzed in the study:

- Costs of data acquisition and preparation of ISR applications
- Costs of potential time delays associated with ISR
- Costs of design changes (e.g., roadway modifications or transit improvements) associated with ISR.

In addition, the study assessed the effects of ISR on facility location and size.

3. Effects of Reducing Auto Use

a. Energy Consumption –

Table 17 shows the average energy consumption per passenger mile travelled for alternative modes of urban transportation. As shown in the table, transit is considerably more energy-efficient than the automobile. Thus, reductions in automobile use achieved by diverting automobile travellers to transit will reduce energy consumption. For example, the diversion of 20 percent

TABLE 17

Energy Consumption of Alternative Modes of Urban Transportation (BTU per Passenger Mile)[a]

Auto	Bus	Electric Transit
5900[b] 8000[c]	3600	4400

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a. Source: Ref. 6

b. Daily average. Assumes 1.9 persons per automobile, 8.5 passengers per bus, and 50-60 passengers per rail car.

c. Work trips. Assumes 1.4 persons per automobile.

TABLE 18

Estimated Annual Energy Consumption by I-66 Transportation Option (1995)[a]

Option	BTU's (10^6)	Percent change from Base Case
Base	212,889,180	0
Transit	200,592,464	-6
Highway	213,426,888	+0.3
Multi-Mode/ New Facilities	201,295,707	-5
Multi-Mode/ Existing Facilities		
Suboption 1	201,006,140	-6
Suboption 2	201,295,707	-5

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a. Source: Ref. 1

TABLE 19

Total Resident Population and Employees Exposed to Various Noise Levels Due to Major Highways in the I-66 Corridor (1995)[a]

Sound[b] Level	Group	Base Case	Transit Option	Highway Option	Multi-Mode/ New Facilities	Multi-Mode/Existing Facilities Suboption 1	Suboption 2
60	Population	343,000	306,000	364,000	326,000	319,000	336,000
	Employees	632,000	526,000	647,000	620,000	648,000	607,000
70	Population	62,000	56,000	67,000	59,000	58,000	61,000
	Employees	117,000	99,000	121,000	115,000	121,000	112,000
80	Population	3,400	2,800	4,800	4,000	3,500	4,400
	Employees	4,500	3,000	6,600	4,900	5,900	5,700

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a. Source: Ref. 1

b. Peak hour dBA(L_{10})

of daily automobile travel to transit would reduce daily energy consumption by passenger vehicles by about 7 percent assuming transit load factors and auto occupancies do not change significantly. If the 20 percent reduction in automobile usage were achieved by diverting commuters, the energy savings would be about 10 percent.

The I-66 study (Ref. 1) estimated the energy consumption associated with the transportation options that were examined. The results are shown in Table 18. The Transit Option requires about 6 percent less energy than the Base Case or Highway Option.

Reductions in automobile use achieved through carpooling will achieve energy savings approximately proportional to VMT reductions assuming that carpooling causes no significant change in the average weight of the vehicles driven. Thus, a 5 to 10 percent reduction in automobile VMT achieved through carpooling is likely to reduce automobile energy consumption by roughly 5 to 10 percent.

b. Transportation Noise

The Federal Highway Administration has established design criteria for transportation noise in terms of L10, the noise level exceeded 10 percent of the time. Among the case studies cited here, only the I-66 study evaluated the noise effects of the transportation options examined. The I-66 results indicate that the diversion of automobile travellers to transit is capable of reducing exposure to highway generated noise. Table 19 shows the I-66 estimates of population and employees exposed to elevated levels of highway noise. Relative to the Base Case the Transit Option decreases exposure to elevated noise levels by 10 to 20 percent, depending on the noise level, whereas the Highway Option increases exposure to noise by as much as 47 percent.

c. Traffic Safety

Transit buses have roughly 1 fatality per 100 million passenger miles (Ref. 7) compared to about 1.6 fatalities per 100 million passenger miles for cars in urban areas (Ref. 8, 9). Table 20 shows the approximate costs of bus and car accidents in urban areas, including property damage, injuries, and fatalities. Bus accident costs per passenger mile are roughly two thirds those of cars.

TABLE 20

Accident Costs in Cents Per Passenger Mile

Roadway	Bus[a]	Car[b]
Freeway	.2	.3
Surface Street	.4	.7

a. Source: Ref. 10

b. Sources: Ref. 11 for accident rates and Ref. 12 for accident costs. Auto occupancy of 1.9 passenger miles per vehicle mile assumed.

Buses have significantly lower fatalities and accident costs per passenger mile than cars. Therefore, the diversion of travellers from cars to buses will reduce fatalities and accident costs. Moreover, the diversion of auto trips to transit will tend to reduce congestion for the remaining auto trips (Subsection 3d), resulting in a lower accident rate for auto travellers.

The accident, injury, and death rates projected for the transportation options considered in the I-66 study are displayed in Table 21. The Transit Option has 10 percent fewer accidents, injuries and deaths than the Base Case and 10 to 12 percent fewer than the Highway Option.

Carpooling will reduce the average frequency of automobile accidents due to the reduction in daily VMT caused by carpooling. However, the severity of individual accidents may increase owing to the increased number of persons per car. Thus, the reductions in injuries, deaths, and accident costs associated with carpooling are likely to be less than proportional to the VMT reductions achieved.

d. Traffic Congestion and Highway Construction

Buses require the roadway space of less than two cars but carry up to 50 times as many passengers per vehicle as cars. Thus, the diversion of auto drivers to transit as well as to carpools will reduce traffic volumes and congestion. Reduced congestion will result in reduced need for further highway construction.

The I-66 study found that the Highway Option produced the most extensive amount of congested

TABLE 21

Comparison of 1995 Traffic Accidents, Injuries, and Deaths in the I-66 Corridor by Transportation Option (1995)[a]

Option	Accidents No.	Accidents %Change[b]	Injuries No.	Injuries %Change[b]	Deaths No.	Deaths %Change[b]
Base Case	6475	0	2625	0	93	0
Transit	5835	-10	2370	-10	84	-10
Highway	6510	+1	2685	+2	95	+2
Multi-Mode/ New Facilities	5900	-9	2430	-7	87	-6
Multi-Mode/ Existing Fac.						
Suboption 1	5960	-8	2445	-7	87	-6
Suboption 2	5910	-9	2430	-7	86	-8

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a. Source: Ref. 1

b. Relative to base case

roadway of any of the options investigated except the Base Case. The Transit Option was found to have the most extensive amount of uncongested roadway. Moreover, with the Transit Option, 68 percent of morning peak VMT in the I-66 corridor take place under uncongested conditions compared to 61 percent for the Base Case and 60 percent for the Highway Option. The Highway Option produces greater congestion than the Transit Option despite the substantially increased highway construction associated with the former option.

TABLE 22

Average Travel Times Associated With Various Transportation Options (in Minutes)

Study	Base Case	Transit Option	Highway Option
I-66[a]	27	27	27
Baltimore[b]			
Peak	NA[d]	20	19
Off-peak	NA[d]	16	15
San Diego[c]	15	17	NA[d]

a. Source: Ref. 1 – Work trips only
b. Source: Ref. 2
c. Source: Ref. 5 – Transit Option is Alternative 1.
d. Not applicable

The Baltimore study (Ref. 2), which was directed at determining whether bus transit can alleviate peak hour overloads on urban highways concluded:

> Based on the findings of this study, bus transit systems may be seriously considered as an alternative to the construction of additional highways in large urban areas.... Bus transit is capable of alleviating peak hour overloads on urban freeways. Radial freeways in the densest part of the city can be relieved of peak hour demand to the degree where, in the near future, no additional resources would be required to provide additional capacity.

The Shirley Highway study (Ref. 3) found that the express bus service caused a reduction in automobile volume of roughly 3000 vehicles in the Shirley corridor during the monring peak. The study concluded that:

> Had the large numbers of express bus riders not been diverted from auto travel, the highway system would have been severely overtaxed and all auto users would have been subject to considerable additional delay.

Three additional lanes of roadway in each direction would be needed to carry present bus riders in automobiles at the existing automobile service level.

e. Travel Time

Transit requires more time than the automobile for access, collection, and distribution. Transit also loses time relative to the automobile if transit vehicles make stops during the linehaul portions of their routes. These transit time disadvantages can be offset in congested corridors and for long trips by the use of express bus routes and priority treatment for transit vehicles. Nonetheless, it is likely that substantial diversions of auto drivers to transit on a regional scale will increase average travel times.

Carpools also have a time disadvantage relative to the single-occupant automobile. This disadvantage is incurred during collection and distribution and, as in the case of transit, can be offset to some extent by the provision of priority treatment. However, the principal disadvantages of carpools are likely to be associated with the schedule inflexibility imposed by carpooling and the difficulties associated with finding suitable partners, rather than with travel time.

Table 22 shows the average travel times associated with some of the transportation options examined in the I-66, Baltimore, and San Diego studies. The average travel times are equal in the case of I-66, because the transportation options affect only trips in the I-66 corridor whereas the average travel time is evaluated for the entire Washington area. In Baltimore and San Diego, the transit options increase average travel times by one to two minutes. Larger increases in travel time would be likely to result from transportation options that achieve greater VMT reductions.

f. Direct Monetary Costs of Transportation

Among the transportation studies cited here, only the Baltimore study reports the total direct monetary costs of the transportation options examined.* The Baltimore costs are displayed in Table 23. The Transit Option costs about 3 percent less than the highway option. This cost difference is within the limits of error of the estimation technique used, so the two options should be considered to have approximately equal total costs.

The I-66 study does not report the total costs of the alternatives it examined. Therefore, the information provided in the I-66 study has been used to derive rough estimates of the costs of the various options. The estimates were derived as follows:

(1) Capital costs reported in the I-66 study were annualized using a 25-year service life and 10 percent annual interest.

(2) Operating and maintenance costs for the highway and transit facilities in the I-66 corridor were obtained from the I-66 report.

(3) Auto operating costs in the corridor were estimated by multiplying the reported corridor VMT by the average operating cost of an automobile exclusive of taxes (Ref. 13).

(4) Items 1-3 were summed to obtain estimated annualized costs.

The I-66 cost estimates are displayed in Table 24. These rough estimates suggest that the Base Case and Transit Options have roughly the same costs and that the Highway Option costs approximately 23 percent more than either of the former options.

The Baltimore and I-66 results indicate that the total costs of transit approaches to travel can be less than the costs of automobile approaches. However, the means of financing transportation improvements do not normally require all transportation system users to pay their exact

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*Total direct monetary costs include the costs of construction, purchase, operation, and maintenance of transportation facilities and vehicles. Other types of costs, such as the costs of environmental damage and travel time, are not included.

TABLE 23

Annualized Costs of Baltimore Transportation Options (Millions of Dollars)[a]

Annual Interest Rate	Transit Option	Highway Option
6%	599.7	617.3
12%	594.5	612.5

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[a] Source: Ref. 2

shares of system costs. Therefore, even though transit-oriented systems may have lower total costs than automobile oriented systems, it does not necessarily follow that the costs of transit-oriented systems are lower for all affected financial units. For example, the Baltimore study found that the Transit Option would reduce transportation system user costs by about $8 million annually relative to the Highway Option. However, the transit system requires a larger subsidy under the Transit Option than under the Highway Option. The situation is reversed in the case of I-66. Net transit revenues after deducting debt service and operating costs are about $4 million per year greater with the Transit Option than with the Highway Option. However, transportation system user costs for home-to-work travel are about $7 million per year higher with the Transit Option.

The diversion of auto drivers to carpools will reduce transportation costs by an amount approximately proportional to the resulting VMT reduction. Thus, a 5 to 10 percent VMT reduction achieved through carpooling is likely to reduce transportation costs by roughly 5 to 10 percent.

TABLE 24

Estimated Annualized Costs of Transportation Options in the I-66 Corridor

Option	Cost[a]	%Change Relative to Base Case
Base Case	198	0
Transit	200	1
Highway	244	23
Multi-Mode/ New Facilities	244	23
Multi-Mode/ Existing Facilities		
Suboption 1	232	17
Suboption 2	234	18

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[a] Millions of dollars per year

4. Effects of Parking Restrictions

a. Supply Reductions

Apart from the effects of reduced auto use described in the foregoing sections, parking supply reductions to discourage auto use may restrict accessibility to places of employment and business. Thus, it is necessary to insure that transit and carpools can substitute for the automobile to the extent required by parking supply reductions.

There is now considerable evidence that transit and carpools can replace the private automobile for travel to work when parking is restricted at the work location. For example:

- The Pittsburgh parking strike caused the closing of 80 percent of the parking spaces in downtown Pittsburgh. During the strike a number of improvements and additions to transit service were made. Most commuters switched to transit. Absenteeism among employees remained normal. Moreover, the parking spaces that were available during the strike were not fully utilized (Ref. 4).
- The Pentagon in Washington, D.C., has achieved a ratio of 0.4 parking spaces per employee. About 50 percent of Pentagon employees commute to work in carpools. Another 35 percent use transit buses or buspools.
- At the National Aeronautics and Space Administration, where parking space is limited, a carpool program has achieved an auto occupany rate of 3.85 persons per car. This is equivalent to 0.26 parking spaces per employee.

These examples illustrate the ability of transit and carpools to substitute for the single-occupant automobile for travel to work when parking availability is restricted.

There has been considerably less experience with the use of parking restrictions in connection with non-work travel. Accordingly, the ability of transit and carpools to substitute for the low-occupancy automobile is less clear in the case of non-work trips than in the case of work trips.

During the Pittsburgh parking strike, total retail sales declined by 6 to 8 percent. Some retail establishments reported sales reductions as large as 15 percent, but others reported sales increases. Theaters reported a 60 to 70 percent decline in patronage. Other entertaining and dining establishments reported reductions in patronage from 10 to 70 percent. However, there were indications that businessmen might accept restricted auto access to the central business district if peripheral parking with downtown shuttle bus service were provided. This suggests that the decline in downtown business during the parking strike may have been caused by a lack of adequate transit service for non-work trips rather than the inability of transit to serve these trips.

The experience with auto-free zones in Europe and the United States suggests that traffic reductions can actually enhance the attractiveness of commercial districts when adequate alternative access is provided. (In the case of auto-free zones access is usually on foot). Indeed, this has been the stated reason for establishing auto free zones in many cities. A study by the Organization for Economic Cooperation and Development of the effects of traffic bans reported the following (Ref. 14):

> Available evidence indicates that traffic bans do indeed have a positive effect on retail sales. In Vienna shopowners reported a 25 percent to 50 percent increase in business in the first week after the traffic ban went into effect. In Norwich [England] all but two shops in the exclusion area did more business, some experiencing an increase in sales of 10 percent or more. In Essen the increase in trade has been reported to be

> between 15 percent and 35 percent depending on the type of shop; in Rouen, between 10 percent and 15 percent. In Tokyo, of 574 shops surveyed, 21 percent showed an increase in sales, 60 percent no change, and 19 percent a decrease; 74 percent of the merchants interviewed pronounced themselves in favor of the scheme.

The OECD study also reported that in Florence some merchants went on strike to protest their street's exclusion from a traffic ban zone.

In Atlanta, 40 percent of the people attending football games at Atlanta Stadium travel to the stadium by bus.

The foregoing examples indicate that commercial areas do not necessarily require automobile access to be successful and that transit may be capable of providing suitable access to non-work destinations when automobile access is restricted. However, considerably more experience with transit use and parking restrictions for non-work travel is needed before these tentative conclusions can be made firm. Initial emphasis should be given to encouraging transit usage for non-work travel in place of expanding existing parking facilities, and to restricting parking in areas where transit service is good and traffic volumes are already excessive or roadway capacity is limited.

b. Parking Surcharges

A parking surcharge at a given location prohibits automobile access to that location by persons unable or unwilling to pay the surcharge. In addition, the surcharge causes a transfer of income to the collection authority from persons willing to pay the surcharge. Parking surcharges therefore present two issues that are distinct from the issues associated with other approaches to reducing automobile use. These are:

- Whether transit and carpools can provide satisfactory access to surcharged locations at a cost that is comparable with the pre-surcharge automobile cost, thus enabling current automobile users to avoid the personal financial effects of charging the automobile an increased proportion of the true costs of its use.
- What should be done with the revenue raised by parking surcharges. The ability of transit and carpools to provide access to locations where automobile use is restricted was discussed in Subsection 4a. The cost and revenue effects of surcharges are considered in this subsection.

Parking surcharges, because they encourage the use of transit and carpools in place of more costly single-occupant automobiles, are likely to reduce the total cost of urban transportation (see Subsection 3f). The effect of surcharges on the out-of-pocket cost of transportation to an individual traveller depends on the structure of the surcharge, the kinds of trips to which it applies, the type of transportation used by the traveller prior to the establishment of the surcharge, and the traveller's response to the surcharge. Table 25 shows some of the possibilities for the case of an individual who, before the establishment of a parking surcharge, drives 5 miles to work in a standard size car with no passengers and free parking. Depending on the structure of the surcharge and the response of the individual, his out-of-pocket cost of travel to work would decrease by as much as $0.67 per day or increase by as much as $2.00 per day.

TABLE 25

Effect of Parking Surcharge On Out-of-Pocket Cost of Work Trip[a]

Surcharge	Mode after Surcharge	Daily Increase (+) or Decrease (-) in Out-of-Pocket Cost Per Person
$1.00	Single occupant car	+$1.00
	2-person carpool	0
	3-person carpool	-0.33
	Transit with $0.50 one-way fare	0
$2.00	Single-occupant car	+$2.00
	2-person carpool	+0.50
	3-person carpool	0
	Transit with $0.50 one-way fare	0
$2.00 on Single-occupant cars only	Single-occupant car	+$2.00
	2-person carpool	-0.50
	3-person carpool	-0.67
	Transit with $0.50 one-way fare	0

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[a] Based on commuter who drives 5 miles to work in a standard-size car with no passengers and free parking.

The revenue-raising potential of parking surcharges is substantial. For example, there are approximately 600,000 home-to-work auto driver trips daily in the Washington, D.C. area. If a $2.00 surcharge assessed only on single-occupant automobile trips to work caused all but 10 percent of auto drivers to form carpools or switch to transit, $30 million per year still would be collected in surcharges. This is nearly double the FY 1974 operating deficit of the Washington transit system.

There has been virtually no experience with parking surcharges in the United States. The 25 percent San Francisco parking tax described in Chapter 3, which affected both work and non-work travel, reduced parking lot revenues by about one third but had no measurable effect on business activity and an insignificant effect on traffic (Ref. 15). Many automobile travellers apparently either shortened the durations of their trips or found parking spaces that were not taxed. The parking tax generated about $5.5 million per year for the city of San Francisco, thus fulfilling the purpose for which it was enacted. No information is available on the effects of the tax on out-of-pocket transportation costs.

The San Diego study estimated that the parking surcharge considered under Alternative 1 would generate revenues of nearly $200 million per year. The surcharges associated with Alternatives 2 and 3 would produce about $60 million per year. These revenues are considerably larger than the costs to local government of implementing the alternatives.

The San Diego study did not consider how local government might use the revenues generated by the various surcharges. This question is of particular importance in the case of the San Diego study, because all of the surcharge approaches evaluated in the study were found to be regressive. In other words, the surcharge payments would be a greater percentage of the disposable income of low-income households than of high-income households. This regressive characteristic could be compensated if the surcharge payments were returned to citizens in the form of services or reductions in non-transportation-related taxes. The San Diego study did not examine the effects on business activity of parking surcharges.

The San Diego example shows that it is necessary to investigate the possible regressive effects of parking surcharge programs when these programs are being designed. It is also necessary to develop approaches to compensating for regressive effects if they are found. However, it cannot be concluded from the San Diego study that all parking surcharge approaches are necessarily regressive. For example, the San Diego surcharges were assessed throughout the San Diego area regardless of transit service quality. It may be that the regressive effects of surcharges can be reduced or eliminated by establishing the surcharges only in places well served by transit (as EPA had proposed for the Washington, D.C. area). Moreover, the transit service quality assumed in the San Diego study was relatively poor compared to service quality in many other cities. Transit attracted less than 12 percent of work trips in the San Diego analysis, even with a $2.50 per day parking surcharge, whereas 20 percent of work trips use transit under existing conditions in cities such as San Francisco and Washington. With no surcharge only 5 to 8 percent of work trips used transit in the San Diego study. This is approximately equal to current transit usage for work trips in Los Angeles. It may be that the provision of high quality transit service in connection with parking surcharges will eliminate the regressive effects of surcharges.

More research is needed to fully understand the effects of parking surcharges. This research will be most effective if it includes actual experience with surcharges. Initial experience might be achieved in connection with work trips to congested locations that are well served by transit and that suffer from a shortage of parking space or have underpriced parking.

4. Effects of Indirect Source Review (ISR)

ISR consists of an air quality review prior to the construction of a large scale development that attracts automobile traffic. The purpose of this review is to determine whether the facility and surrounding road network can manage the attracted traffic in a manner that does not lead to violation of the ambient air quality standard for carbon monoxide. In this review, the number of parking spaces at a facility is used as an initial indicator of the quantity of traffic that the facility may attract and, thereby, of the potential for the development or aggravation of an air quality problem. The principal focus of ISR is on facility design, the characteristics of the transportation system serving the facility, and, to a lesser extent, facility location. Measures that a developer can adopt, if necessary, to prevent the accumulation of excessive carbon monoxide concentrations include facility design changes, improvements in the capacity of the road network serving the facility, transit improvements, carpooling incentives, and reductions in parking supply.

The ISR-related costs estimated for the six cases analyzed in the ISR study (Ref. 16) are displayed in Table 26. The costs are 1 to 2 percent of total project cost in four cases, 7 percent of project cost in one case, and 23 percent of project cost in one case. In comparison, the costs of air pollution control equipment for new industrial facilities can increase the costs of these facilities by as much as 35 percent. ISR costs are greatest relative to total project cost for shopping centers.

The cost elements associated with ISR are displayed in Table 27. The costs of data acquisition and preparation of an ISR application were found to be $5,000 to $45,000, depending on the methodology used project air quality. These costs are less than 0.1 percent of total project costs. Further, they represent only 10 to 15 percent of the developer's front-end money used to initiate the project.

There are two types of costs associated with construction delays that could be caused by ISR. The first is the cost of inflation during the period a project is delayed. The second is the opportunity cost incurred when a developer's money is tied to a project longer than anticipated, thus causing this money to be unavailable for use in a new investment. In three of the six projects analyzed in the ISR study, a 90-day delay due to ISR would reduce developer's return-on-investment by roughly 0.2 percent. In the other three projects, 90-day delays would cause a 1 percent drop in return on investment. The 90 day delay costs represent 3.5 to 7.5 percent of the developer's front-end money. Delay costs are not likely to occur in the future when experience with ISR is acquired and developers begin to anticipate ISR needs in the initial stages of project design.* In all of the projects examined, delay costs could be eliminated entirely through proper planning and administration of the ISR process by both developers and the review agency.

Design changes, when they are necessary to prevent violation of the carbon monoxide air quality standard, are the principal source of ISR-related costs. However, the effects of these costs vary depending on the nature of the development involved. Mixed use and office developments seem not to be greatly affected by ISR. Only two of the four office and mixed-use developments examined in the ISR study would require design changes. The costs of these changes would be 0.3 to 1.6 percent of total project costs. This constitutes a 0.5 percent reduction of return-on-investment. The effects of design-change costs on these developers could be reduced significantly through public assumption of all or part of these costs. However, even if the developers bore all of the costs, no rental increases or changes in investment decisions would be needed in the mixed use and office projects studied.

Transit approaches to design changes would be feasible for both of the mixed-use and office developments that require design changes. In Project E, a savings of $192 per parking space could be achieved by replacing on-site parking with park-and-ride. In Project D, transit has a lower initial cost than highway related design changes. If the developer had to absorb all operating and maintenance costs of the proposed transit

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*Many of the design features expected to result from ISR frequently are incorporated into project design even without ISR.

TABLE 26 – Effect of ISR On Total Project Costs For Six Case Studies[a]

	Office Space		Shopping Center		Mixed Use	
	Project A	Project E	Project B	Project F	Project C	Project D
Total Project Cost						
a. Without ISR	31.4	24.8	37.2	13.7	27.8	114
b. With ISR and No Delay	31.4	25.0	38.9	16.6	27.8	116[d]
c. With ISR and 90-day Delay	31.7	25.1	39.8	16.8	28.2	116[d]
Percent Increase in Project Cost						
a. With ISR and No Delay	0.7	0.7	5	21	0.02	1
b. With ISR and 90-day Delay	1	1	7	23	1	2
Return on Investment						
a. Without ISR	19.1	21	14	30	12.8	-3.9[b]
b. With ISR and No Delay	19	20.2	12	24.7[c]	12.8	-4.2[b]
c. With ISR and 90-day Delay	18.6	20.1	11	23.5[c]	12.1	-4.4[b]

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a. Source: Ref. 16. Assumes developer pays all costs, 12 percent annual inflation, 1975 automobile population. Costs in millions of dollars.
b. Project D is financed as tax shelter.
c. With 8 percent increase in rents.
d. The lack of a difference between rows b and c is due to round-off.

TABLE 27 – Cost Elements Associated With ISR[a]

	Office Park		Shopping Center		Mixed Use	
Cost Element	Project A	Project E	Project B	Project F	Project C	Project D
Data and Application	45	5	35	10	5	40
Review Process with No Delay	0	0	0	0	0	0
Review Process with 90-day Delay	278	48	917	291	466	851
Design Changes with Interim Financing	0	174	1650	2890	0	1590

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a. Source: Ref. 16. Assumes 12 percent annual inflation and 1975 automobile population. Costs in thousands of dollars.

TABLE 28 – Effect of Automobile Emissions Controls On Future Design Change Costs[a]

	Highway-Related			Transit-Related[b]		
	1980	1985	1990	1980	1985	1990
Case B	$1,250,000	$1,250,000	$1,167,000		Not applicable	
Percent of base year cost	92%	92%	86%			
Case D	$539,000	$132,000	$000	$90,000	$20,000	$000
Percent of base year cost	37%	9%	0%	82%	18%	0%
Case E	$354,000	$40,000	$40,000	$155,250	$40,000	$40,000
Percent of base year cost	40%	11%	11%	40%	26%	26%
Case F	$300,000	$200,000	$000		Not applicable	
Percent of base year cost	32%	21%	0%			

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a. Source: Ref. 16. Costs in constant dollars based on original project completion date (base year).
b. Costs exclude annual operating costs.

service, this approach to design-changes would be less attractive economically than highway modifications. The transit option would be attractive to the developer if the community absorbed operation and maintenance costs.

The six cases examined in the ISR study suggest that the effects of design-change costs are likely to be most significant for large shopping centers. This is due both to the nature of the traffic generated by these facilities and their difficulties in adopting certain low-cost transportation options (e.g., carpooling). In the two shopping center developments studied, design changes would increase project costs by 4 and 21 percent. In the latter case, which consists of an expansion of existing facilities, an 8 percent increase in rents or some public funding of design changes would enable the development to proceed as planned with anticipated profits. In the former case, the shopping center is located in a heavily congested area. Although the immediate area around the project is well-served by transit, 60 percent of the shopping center's trade depends on commuter automobile trips by persons living outside of the project's vicinity. Unless the public assumed responsibility for major roadway modifications, ISR would be likely to prevent the development from being built as planned. However, the development could be built if it were reoriented to serve the local population which has good transit service.

Design changes to prevent excessive carbon monoxide accumulations indicate the need for ISR. The ISR study found that the air quality problems necessitating design changes will persist over time despite the gradual replacement of old, high-emitting cars with newer and cleaner ones. However, the costs of design changes will decrease as the car population becomes cleaner (Table 28).

The ISR study found that ISR and its attendant costs might provide shopping center developers a marginal incentive to locate in suburban areas where air quality is relatively good and ISR-related costs would be minimized. The effect of ISR on suburbanization of office buildings was found to be small compared to the effects of the state of the economy, the availability of Federal funding, and the availability of labor. Short of denial of a permit for construction, ISR was found to have no effect on the location of mixed-use developments.

In the case of shopping centers, ISR was found likely to have a much greater effect on facility size than on facility location. "The economics of [shopping center] developments above and below the triggering point for review are not sufficiently different for a developer to feel a large degree of hesitancy about reducing the size of a facility to avoid the potential costs and uncertainty of applying for an ISR permit" (Ref. 16). The sizes of office buildings and parks probably will not change as a result of ISR. Rather, office building developers will reduce the sizes of their parking facilities and rely on transit, carpooling, staggered work hours, or off-site parking instead. There was insufficient information to evaluate the effects of ISR on the sizes of mixed-use developments.

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chapter 6 - the relationship of transportation controls to other aspects of transportation planning and decision-making

1. Problems of Present Urban Transportation Systems

The principal orientation of urban transportation planning in the United States is toward long-range, capital intensive programs to expand highway capacity. In the period 1957-1970, Federal expenditures for urban highway construction exceeded $21 billion, whereas less than $2 billion was spent to purchase buses or improve the efficiency with which existing urban roads are used. Between 1960 and 1970 total street and highway mileage in cities increased by 30 percent, whereas bus route-miles increased only 4 percent (Ref. 1).

The predominance of the automobile as the means of urban transportation has created a wide variety of transportation problems in addition to deteriorated air quality. These problems include:

- Traffic congestion
- The decline of public transit
- Excessive noise
- Excessive energy consumption for transportation purposes
- Excessive property losses, injuries, and deaths due to traffic accidents
- Disruption and deterioration of residential areas and business districts as a result of roadway construction
- Lack of mobility for non-drivers.

These urban transportation problems are complex and will not be solved easily or quickly. However, they can be mitigated through the implementation of measures to discourage the use of low-occupancy automobiles and encourage the use of transit and carpools (see Chapter 5). Moreover, there is growing agreement that the historical orientation of urban transportation planners and managers toward long-term, capital intensive programs must be modified to provide increased emphasis on the development and implementation of shorter range, lower cost options that offer the possibility of alleviating current problems.

A variety of low cost, short-range improvements in urban transportation systems have been proposed in response to the need to alleviate current urban transportation problems. These proposals include:

- Priority treatment for high-occupancy vehicles on streets and freeways
- Traffic engineering systems improvements
- Higher capacity transit vehicles
- Work scheduling changes (4-day week or staggered work hours)
- Improved transit service, including linehaul feeder systems, automation of bus scheduling, paratransit (e.g., jitneys), and demand activated bus service
- Organized commuter carpooling
- Parking restrictions
- Economic penalties and incentives, including increased auto-user charges and reduced transit fares
- Facilitating bicycle travel
- Improving urban goods movement.

These proposals have been motivated by a complex cluster of urban transportation problems which include but are by no means restricted to air quality (Ref. 1, 2, 3, 4). Yet, the proposals are virtually identical to the ones that have been offered for inclusion in air-quality related transportation control plans. Thus, air quality requirements are not causing transportation changes that are otherwise unnecessary. Rather, the immediacy of the deadlines for achieving the ambient air quality standards is accelerating the implementation of transportation improvements that are needed to alleviate a wide variety of urban transportation problems.

2. Effects of Transportation Control Requirements on Other Transportation Programs

In recent years, significant attention has been devoted to the process through which transportation improvements are planned and implemented. Environmental considerations, including concern about the air quality implications of transportation proposals, have been a significant force in stimulating changes in the transportation planning process. The following are among the changes that are occurring (Ref. 5).

- Transportation institutions are reorganizing so that a wider range of transportation options may be considered. This shift is evidenced by the formation of departments of transportation with multimodal responsibilities. At the metropolitan level, the requirement that one agency be designated as recipient of both highway and transit funds and proposed requirements for the submission of multi-modal programs of projects indicate further consolidation, or at least coordination, of multimodal transportation planning.
- Transportation agencies at all levels of government are devoting increased attention to environmental effects of proposed actions. This movement is at least partially attributable to the growth of legal requirements dealing with the environment, ranging from the National Environmental Policy Act of 1969 (and the State equivalents of that Act), to environmental sections of transportation laws (e.g., Sections 109(h) – 109(j) of the 1970 Federal Aid Highway Act), to pollution laws such as the Clean Air Act.
- The allocation of resources is becoming a vital concern in transportation planning. The concept of project cost has been expanded to include consideration of the costs of eliminating or minimizing adverse effects.
- Transportation agencies are directing more effort toward the coordination of transportation plans with the plans and proposals of other Federal, State, and local agencies.

Transportation controls are likely to accelerate these trends by necessitating the consideration of a wide range of transportation options, by encouraging increased interagency coordination, and by requiring explicit analysis of the air quality effects of transportation proposals.

Apart from the Environmental Protection Agency, the Department of Transportation is the Federal agency most affected by transportation-related air quality requirements. Changes in DOT policies, programs, and procedures that are attributable wholly or in part to air quality requirements include the following.

a. EPA participation in Intermodal Planning Groups

Intermodal planning groups (IPG's) are established in the standard Federal regions by the Department of Transportation to provide Federal review of State and local planning of transportation projects that receive Federal funds. The voting members of the IPG's are the Urban Mass Transit Administration, the Federal Highway Administration, and the Federal Aviation Administration. IPG responsibilities include assuring that State and local transportation planning processes provide for:

- Adequate integration of highway, transit, and airport-transit planning activities.
- Adequate participation in the planning process by all affected local jurisdictions.
- Adequate consideration of social, economic, and environmental factors.

Since 1973, EPA has participated in IPG's as a non-voting member. This participation provides a means of improving the integration of air quality requirements into transportation planning and decision-making. EPA participation in the Federal Region IX IPG has facilitated the provision of grants to Los Angeles, San Francisco, and San Diego for the purpose of developing parking management plans. The activities of the same IPG together with the efforts of State and local agencies resulted in the development of a short-term transportation plan for Los Angeles that addresses a variety of local transportation problems including air quality. The plan includes priority treatment for buses on streets and freeways and the acquisition of 1600 new buses.

b. Implementation of Section 109(h) of the Federal Aid Highway Act

Section 109(h) requires the Secretary of Transportation to promulgate guidelines designed to assure that possible adverse economic, social, and environmental effects relating to proposed projects on Federal-aid systems are fully considered in developing the projects. The guidelines must also assure that final decisions on Federal-aid projects are made in the public interest, taking into consideration a wide variety of factors including the costs of minimizing adverse effects on air quality.

In response to this requirement, DOT has issued Process Guidelines for the development of action plans to assure that adequate consideration is given to possible social, economic, and environmental effects of proposed highway projects and that the decisions on such projects are made in the best overall public interest (Ref. 6). The guidelines identify issues to be considered in reviewing and developing desirable improvements in the present organizations and processes of State highway and transportation agencies as they relate to social, economic, and environmental considerations. The guidelines recognize the unique situation of each State and do not prescribe specific organizations or procedures.

c. Implementation of Section 109(j) of the Federal Aid Highway Act

Section 109(j) requires the Secretary of Transportation, after consultation with the EPA Administrator, to promulgate guidelines to assure that highways constructed in the Federal-aid system are consistent with approved plans for the implementation of ambient air quality standards pursuant to the Clean Air Act. Further, the National Environmental Policy Act of 1969 requires that adverse environmental effects, including air pollution, be considered in the development of highway proposals.

In response to these requirements, and after extensive consultation with EPA, DOT has issued air quality guidelines for use in planning, location, and construction of Federally aided highway improvements (Ref. 7). The guidelines require that transportation plans and programs developed through the urban transportation planning process be consistent with approved State implementation plans to achieve the ambient air quality standards. The procedures for assuring consistency include consultation by the responsible transportation planning agencies and the Regional Federal Highway Administrator with the appropriate air pollution control agency and the Regional Administrator of EPA.

The guidelines issued by DOT further require that the proposed final environmental impact statement for a highway section shall not be submitted to the Federal Highway Administration for adoption if the responsible indirect source review agency has found that the highway section will result in a violation of applicable portions of an approved emissions control strategy or will interfere with the attainment or maintenance of the ambient air quality standards. The final environmental impact statement may be adopted by the Federal Highway Administration only after the Regional Federal Highway Administrator has determined that the proposed highway section is consistent with the approved State implementation plan. The Regional Administrator of EPA must be consulted on any consistency issues that have not been resolved prior to the submission of the proposed final environmental impact statement.

d. Allocation of Funds to Support the Implementation of Transportation Control Strategies

The transportation control plans of many cities anticipate substantial expansions of existing bus fleets (see Chapter 3). At the request of EPA, DOT has agreed to give priority to funding applications for mass transit capital grants to implement transportation control strategies and to meet the transit demand generated by those strategies. Moreover, DOT has agreed to provide up to $200 million for that purpose in FY 1974-75. Depending on legislative developments regarding the support of transit improvements, DOT is prepared to consider higher funding levels in FY 1976 and FY 1977 if warranted by the demand for buses.

e. Short-range Transportation Plans and Improvements

Section 1 of this Chapter explained the need for increased emphasis on short-range, low cost transportation improvements. As an initial response to this need, the Federal Highway Administration encourages specific consideration to be given to low cost transportation improvements prior to a decision to implement major capital investment projects (Ref. 8). DOT is now developing guidelines for the preparation of short-range transportation improvement programs. These will require urbanized areas to prepare staged 3-5 year, multimodal programs of capital and operational projects consistent with the long-range transportation plan and leading to the achievement of the short-range transportation objectives of the areas. This program will also contain a listing of capital and operational improvement projects proposed for implementation using Federal funds during the first program year.

DOT also is developing requirements for the preparation of unified planning work programs. These programs will be prepared at the local level and will include, among other things, descriptions of the specific technical activities necessary to carry on the transportation planning process for a one to two-year period. Planning work programs also will include assurance that adequate consideration is given to minimizing or eliminating possible adverse social, economic, and environmental effects of proposed projects.

f. Other DOT Actions

At the request of EPA, DOT has agreed to require consistency with applicable transportation control plans in reviewing mass transit capital grant applications. DOT also has agreed to require that the transportation planning efforts supported by DOT in urban areas with transportation control plans address and spell out a strategy for implementing approved transportation control plans or appropriate alternatives thereto.

DOT has given strong support to the principal of removing subsidies to auto use in cities. Secretary Brinegar has stated (Ref. 8):

> We will develop – and encourage local areas to implement – various incentive systems to force more efficient vehicular usage of our existing streets and highways. A necessary part of such an approach is to see that the automobile does, in fact, pay its share of all the costs that it imposes on the cities. This could mean stiff parking taxes and possibly even some form of special "rush hour" license plates. For some cities it might even mean banning or severely limiting automobile access to the central core (Ref. 9).

In response to the Emergency Highway Energy Conservation Act, DOT has initiated a program to support carpool demonstration projects (Ref. 10). Typical projects include locator systems, priority treatment for carpools on streets and freeways, and priority parking for carpools. Projects that encourage substantial numbers of transit riders to switch to carpools are excluded from the program. As of June 30, 1974, a total of 71 carpool demonstration projects in 26 States had been approved.

3. Improving the Integration of Air Quality Requirements into Transportation Planning and Decision-Making

The significance of the foregoing developments is that they promote the development of an integrated transportation planning and decision-making framework in which decisions about air quality and decisions about interacting social objectives can be made together, trade-offs can be made among conflicting objectives where necessary, and full advantage can be taken of the many coincidences between air quality objectives and other transportation objectives. The developing framework places the principal responsibility for developing and implementing transportation controls with State and local authorities, subject to guidance and review by EPA and DOT. Within this framework, transportation planning is understood to be a multi-objective process. Air quality requirements enter the process in the form of constraints. Thus, a community's transportation plan remains oriented toward achieving a variety of objectives that the community has set for itself. However, the means of achieving these objectives must be consistent with air quality requirements.

Future action to increase the integration of air quality planning and transportation planning should address three problem areas:

- Development of adequate institutional structures.
- Acquisition of additional information on the feasibility, benefits, and costs of innovative transportation control approaches including parking restraints, auto user charges, and transit improvements.
- Development of more flexible deadlines for achieving the transportation-related ambient air quality standards.

The solution of these problems is likely to require both administrative action and new legislation. Proposals now under consideration include the following:

a. Increase the Responsibilities of Regional Transportation Planning Agencies for Making Decisions about Transportation Controls

The successful integration of air quality requirements into transportation planning and decision-making will require a much higher degree of coordination among governmental agencies and jurisdictions than now exists. The problems of institutional and jurisdictional fragmentation that inhibit this coordination may be mitigated by increasing the transportation control responsibilities of those agencies in metropolitan areas that are already responsible for adopting a regional transportation plan. Funds for developing and monitoring transportation control strategies could be provided to the agency designated in each metropolitan area as the single recipient of Federal Highway Administration and Urban Mass Transit Administration planning funds. The short range program requirements currently under development by DOT could be expanded to explicitly include transportation control measures.

b. Encourage States and Localities to Experiment with Transportation Control Measures and to Monitor the Results

There are substantial uncertainties associated with the feasibility, costs and benefits of certain transportation control measures. Many of these uncertainties must be resolved through actual experience with the measures. Experiments are needed on various types of parking limitations, pricing policies, transit improvements, and carpooling. The objectives of the experiments should include assessing the effects on mobility of alternative approaches to reducing auto use; demonstrating workable options to the public and to officials; and acquiring improved information about the costs and market responses of various transportation options.

c. Require that Transportation Control Plans Be Reivewed Periodically and Revised as Necessary in an Open Forum

Present regulations require a transportation control plan to be revised if the air quality standards are revised, better methods for achieving the standards are found, or the existing plan is found to be inadequate to meet the standards. However, there is no requirement for a periodic, public review of progress made under a plan, problems that may have arisen, and new information that may have become available since the plan was adopted. Requiring the periodic reassessment of transportation control plans may help officials and the public to understand that they need not be bound to a plan if it proves unworkable or if it is found to be achieving a greater or lesser degree of emissions control than necessary. This, in turn, may create an increased willingness to experiment with transportation control approaches.

d. Provide Increased Flexibility in the Deadlines for Achieving the Transportation-Related Air Quality Standards

In some heavily polluted regions, the reductions in automobile use needed to achieve the transportation-related air quality standards will create considerable disruption. Legislation is needed that will permit greater flexibility in the deadlines for achieving these air quality standards in certain areas while maintaining the requirement that air quality be improved and the standards be achieved as rapidly as possible. A proposal to amend the Clean Air Act to provide this flexibility was transmitted to the Congress in March 1974 (see Appendix C).

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Appendix A

Status of Transportation Control Plans

Measure	City	Approved State (State) or EPA Promulgated (EPA)	Status
STATE OF ALASKA			
Parking management (review of new facilities)	Fairbanks	EPA	EPA has deferred the effective data of the parking management regulations to June 30, 1974. It appears that North Star Borough will submit a local parking management plan.
STATE OF ARIZONA			
Bus Carpool Matching Program	Phoenix and Tucson	EPA	The Cities have notified EPA's regional office of their intent to implement this strategy.
Employer Carpool Incentives (200 employee spaces per facility)	Phoenix and Tucson	EPA	40 Employers have submitted plans to EPA's regional office. These plans are currently being reviewed by EPA.
Parking Management (review of new facilities)	Phoenix and Tucson	EPA	EPA has deferred the effective date of parking management until June 30, 1975.
STATE OF CALIFORNIA			
Preferential Bus/ Carpool Treatment	San Francisco	EPA	The city and state are working on a feasibility study for improving mass transit. EPA's regional office has sent a letter to the State Air Resources Board asking for a positive commitment to implement improved mass transit strategies.
Parking Management (Review of New Facilities)	Los Angeles San Francisco Sacramento San Joaquin San Diego	EPA	EPA has deferred the effective date for this strategy until June 30, 1975. Los Angeles, San Diego, and San Francisco, however, are planning to develop and implement their own comprehensive parking management programs with EPA assistance.
Computer Carpool Matching	Los Angeles San Francisco Sacramento San Joaquin San Diego	EPA	State officials have indicated to EPA that they will implement this program.
Mass Transit Priority – Exclusive Bus Lanes Freeway Ramp Metering	San Diego	EPA	The City of San Diego has indicated to EPA that it will implement these programs.
Priority Treatment for Buses and Carpools	Los Angeles	EPA	The City of Los Angeles has indicated to EPA that it will implement this strategy. Several exclusive lanes have already been established.
Parking Surcharge for public and employee parking	Los Angeles San Francisco San Diego		EPA rescinded all measures relating to surcharges or fees for parking on January 15, 1974.

STATE OF COLORADO

Mass Transit Improvements	Denver	State	The City has implemented the improvements and purchased the buses.
Bus/Carpool Lanes	Denver	State	Experimental lanes are in operation, and the program is progressing smoothly.
On-Street Parking Limitations	Denver	State	The State plans to drop this measure from its plan because there already is little on-street parking in Denver. It will be replaced by other measures.
Parking Management (review of new facilities)	Denver	State	The State has made gradual progress in adopting the regulations to implement this program. However, compliance is likely.
Bikeway	Denver	State	A major portion of the 164 mile project has been implemented.

STATE OF ILLINOIS

On-Street Parking	Chicago	EPA	The full program has been delayed, but a pilot program is in operation
Traffic Flow Improvements	Chicago	State	The TOPICS program has begun according to the required schedule.

STATE OF MARYLAND

Buslanes	Baltimore	EPA	The City has submitted preliminary study results and has a test route in operation.
Bus Fleet Increase	Baltimore	State	Documentation of progress has not been submitted but communications from the Governor indicate good progress on fleet expansion.
Carpool Matching	Baltimore	State	The pilot program is 75% implemented and funding for fiscal year 1975 has been secured.
Employer Incentives for Mass Transit (700 employee spaces per facility)	Baltimore	EPA	Requests for information have been sent to about 60 employers. Of the 12 plans submitted, only a few were approvable. EPA is working with the employers to improve the submissions.
Traffic Flow Improvements	Baltimore	State	A letter from the Governor indicates that the required study is completed and that compliance is likely.
Bikeways	Baltimore	EPA	The required study has been initiated according to schedule.
Management of Parking Supply (review of new facilities)	Baltimore	EPA	EPA has deferred the effective date until June 30, 1975.

STATE OF MASSACHUSETTS

On-Street Parking Limitation	Boston and Springfield	EPA	Neither city has submitted required legal and administrative procedures nor implemented the first phase of the program. Both the State and cities, however, indicate a willingness to implement this strategy.
Parking Management	Boston		The first circuit court decision *South Terminal Corp., et al., v. EPA,* 6 ERC 2025, (September 27, 1974) suspended implementation of the parking management regulation, except for the provision on employer incentives, until the air quality data base has been revised. On August 19, 1974, EPA sent out 390 Section 113 notices of violation for employer action plans. Prior to this activity 700 action plans had been submitted. Subsequent to this activity over 200 additional action plans have been received by EPA.
a) CBD freeze		State	
b) New facility review		EPA	
c) Employer mass transit incentives (50 employees per facility)		EPA	
Preferential Bus/ Carpool Treatment	Boston	EPA	Boston failed to submit a compliance schedule which was due on August 1, 1974. The city also failed to implement preferential bus/carpool treatment for Route I-93.
Regulation for off-street parking facilities, 25¢ per hour surcharge	Boston and Springfield	EPA	EPA rescinded the surcharge for Boston and Springfield on January 15, 1974.
40% vacancy rate in CBD	Boston	EPA	This measure was also suspended by the above cited court decision.
Computer Carpool Matching Program	Boston and Springfield	State and EPA	Radio station WBZ/ALA just completed area-wide program. Massachusetts is planning to start a state-operated program of its own.
Regulation for Logan egress toll	Boston	EPA	EPA also rescinded all surcharges and tolls for Logan Airport on January 15, 1974.

STATE OF MINNESOTA

Traffic Management System	Minneapolis	State	The City has implemented the program according to schedule.
Fringe Parking	Minneapolis	State	The fringe lots are being constructed in compliance with the required schedule.

NATIONAL CAPITAL
(Including D.C., Maryland, and Virginia Suburbs)

Bus Fleet Increase	D.C., Maryland and Virginia Suburbs	State	Buses have been purchased according to schedule.
Exclusive Busways	D.C., Maryland and Virginia Suburbs	State	All jurisdictions are actively studying, and some lanes are operational or under construction. Other lanes will probably be substituted for less effective proposed lanes after thorough study. Substantial, though tardy compliance is likely.
Bikeways	District of Columbia	EPA	Compliance dates have been missed, but the City has submitted an alternative proposal to EPA.

Bikeways	Maryland and Virginia Suburbs	EPA	There have been substantial efforts by local jurisdictions to comply.
On-street Parking Restrictions	D.C., Maryland and Virginia Suburbs	State	The jurisdictions were given a delay until the Council of Governments defined "adequately served by mass transit". D.C., Arlington and Montgomery County have enacted regulations.
Parking Management (review of new facilities)	D.C., Maryland	EPA	EPA has deferred the effective date until June 30, 1975.
Parking Surcharge, Commercial Rates for Federal Employee Parking	D.C., Maryland and Virginia Suburbs	EPA/State	EPA rescinded all measures relating to surcharges or fees for parking on January 15, 1974.

STATE OF NEW JERSEY

Preferential Bus/ Carpool Treatment	New Jersey Suburbs of New York and Philadelphia	EPA	New Jersey has a contra-flow bus lane in operation on route I-495 between the New Jersey Turnpike and the Lincoln Tunnel. The State has received a $376,000 grant for conducting a feasibility study and demonstration projects for other routes. New Jersey officials are also considering an exclusive bus lane to the Ben Franklin Bridge.
On-street Parking Limitation	Camden, Newark, and Trenton CBD's	EPA	An EPA provided contract is supplying a comprehensive parking management analysis for the three CBD's. Camden and Trenton have made submittals indicating their intent to implement these strategies.
Parking Management (review of new facilities)	New Jersey Suburbs of New York and Philadelphia	EPA	EPA has deferred the effective date of this regulation to June 30, 1975. The EPA contractor's report will also be used to develop a comprehensive parking management program for these areas.
Employer Mass Transit Priority Incentives (400 employee spaces per facility)	New Jersey Suburbs of New York and Philadelphia	EPA	The original promulgated regulation required parking fees. This regulation was rescinded on January 15, 1974. A new regulation was proposed and promulgated June 4, 1974. 115 Employers have submitted plans under the new regulation. This represents approximately 95% of the employees covered. EPA's regional office is proposing to contact employers who failed to submit plans.
Vehicle Free Zones	Trenton	EPA	The city has put into effect a partial vehicle free zone.
Carpool Matching Program	New Jersey Suburbs of New York and Philadelphia	EPA	Camden and Trenton are using the New Jersey/ DOT Carpool program. Newark has not made substantial progress on this program.

STATE OF NEW YORK[1]

Improved enforcement of traffic regulations	New York	State	The City has hired an additional 1,000 "Meter Maids" to enforce the on-street parking restrictions.
Exclusive bus lanes and improved express service	New York	State	The City has had this strategy in effect but has not yet improved or expanded the service. Many of the express service buses do not have exclusive lanes or priority treatment.
Staggered work hours and days	New York	State	City and State agencies are implementing staggered work hours. No one has implemented staggered work days.

STATE OF OREGON

Buslanes and other transit improvements	Portland	State	All measures except the installation of park and ride shelters are being implemented on schedule.
Parking Management (review of new facilities)	Portland	State	The State is currently reviewing the construction of new parking lots, and the City is considering adoption of a local parking management plan.

STATE OF PENNSYLVANIA

Buslanes	Pittsburgh and Philadelphia	EPA	The State has completed several studies and is now selecting the best routes. Compliance is likely.
Carpool Matching Program	Pittsburgh and Philadelphia	State	A contracted matching program is ongoing, although no documentation has been submitted to EPA.
Employer Incentives for Mass Transit (700 employee spaces per facility)	Pittsburgh	EPA	With the cooperation of the local planning commission, the program is proceeding. EPA is working to improve the quality of the 10 programs submitted. Information has been requested from about 30 non-submitting employers.
Bikeways	Pittsburgh	EPA	The program for development and supporting documentation have been submitted.
On-street Parking Restrictions	Pittsburgh and Philadelphia	EPA	This measure is closely associated with the buslanes provisions. No action is expected until after final selection of the buslane routes.
Parking Management (review of new facilities)	Pittsburgh and Philadelphia	EPA	EPA has deferred the effective date of this regulation to June 30, 1975. In Philadelphia, the regulation only affects construction of facilities in the central business district.

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[1] EPA approved New York's TCP on June 22, 1973. Since then New York has submitted a plan revision. The State just completed public hearings on its revised plan. EPA and New York are attempting to work out an acceptable plan.

STATE OF TEXAS

Bus/Carpool lanes	Houston	EPA	There had been little progress made toward implementation prior to the decision in *State of Texas v. EPA*, 499 F.2d 289) 5th Circuit, August 7, 1974). The decision in that case deferred implementation of this measure in Houston and San Antonio and required reconsideration of the measure in Dallas-Ft. Worth.[1]
	Dallas-Ft. Worth	EPA	
	San Antonio	EPA	
Parking Management	Houston	EPA	The measure was also deferred by the 5th Circuit in *State of Texas v. EPA*.[1] Since that case was decided, EPA has deferred the effective date of parking management regulations to June 30, 1975.
Bus/Carpool matching and promotional system	Houston	EPA	Some compliance dates were missed during the progress of Texas' suit against EPA. The outcome of that suit deferred this measure in Houston and San Antonio and required reconsideration in Dallas-Ft. Worth.[1]
	Dallas-Ft. Worth	EPA	
	San Antonio	EPA	
Employer Incentive (700 employee spaces per facility)	Houston	EPA	Several employers submitted programs early in 1974. This measure was deferred in Houston and San Antonio and reconsideration was required in Dallas-Ft. Worth.[1]
	Dallas-Ft. Worth	EPA	
	San Antonio	EPA	

STATE OF UTAH

Pedestrian Mall	Salt Lake City	EPA	The City committed itself to the project, and construction is now underway.
On-Street Parking Restrictions	Salt Lake City	EPA	The City has committed itself to carrying out the program
Bikeway	Provo	EPA	A meeting was held with the Mayor after compliance dates were missed. The Mayor has promised completion by March, 1975.

STATE OF WASHINGTON

Buslanes, park and ride lots and other transit improvements	Seattle and Spokane	EPA/State	Seattle has submitted the required compliance schedule for buslanes, and other cities have submitted reports required by the park and ride regulations. A request for an extension for other transit improvements in Seattle is currently being considered.
Parking management	Seattle and Spokane	EPA	EPA has approved the Washington indirect source regulations which will replace all parking management regulations except the central business district freeze. Permits are currently being given under the freeze provisions.
Computerized carpooling	Seattle and Spokane	EPA	None of the required information or regulations have been submitted. Commitments have been made, however, in each city for certain organizations to take the lead in implementing this strategy.
Bicycle lanes	Spokane	EPA	All of the dates for implementation have been missed, but replacement of this measure is being considered upon completion of an evaluation of alternate measures by a contractor.

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[1] Measures were deferred by the 5th Circuit pending EPA reconsideration of the refinery reactivity factor, used in Texas. Other measures were required to be reconsidered to determine whether they were reasonable in view of the fact that the reductions obtained from these measures are needed only for a short time.

federal register

MONDAY, FEBRUARY 25, 1974
WASHINGTON, D.C.

Volume 39 ■ Number 38

PART III

THE NATIONAL ARCHIVES OF THE UNITED STATES • 1934 •

ENVIRONMENTAL PROTECTION AGENCY

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AIR PROGRAMS; APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS

Review of Indirect Sources

No. 38—Pt. III——1

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 52—APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS

Review of Indirect Sources

On May 31, 1972 (37 FR 10842), the Administrator of the Environmental Protection Agency published his initial approvals and disapprovals of state implementation plans submitted pursuant to section 110 of the Clean Air Act, as amended in 1970. Shortly thereafter, Natural Resources Defense Council, Inc. (NRDC) and various other petitioners challenged the Administrator's approvals in the United States Court of Appeals for the District of Columbia Circuit on several grounds, including the contention that the plans approved were not adequate to insure maintenance of the ambient air quality standards once such standards were attained.

As to this issue, the Court ruled in NRDC v. EPA, 475 F.2d 968 (D.C. Cir. 1973), that the record before the court was insufficient to ascertain whether the Administrator had made a state-by-state determination as to plans' adequacy regarding maintenance. Accordingly, the Court ordered the Administrator to review the maintenance provisions of all approved state implementation plans and to disapprove those plans which (1) did not contain measures necessary to assure maintenance of the primary standards after the statutory attainment date, and (2) did not analyze maintenance in a manner consistent with the Administrator's regulations.

Upon further review, the Administrator determined that no state plan contained all of the measures necessary to assure maintenance of the standards and that no plan had adequately analyzed the impact of growth on air quality maintenance for any significant period of time into the future. Accordingly, on March 8, 1973 (38 FR 6279), the Administrator disapproved all state plans with respect to maintenance of standards.

In the notice of disapproval, the Administrator noted that several mechanisms already available under the Act and in regulations would serve to mitigate the impact of overall community growth on air quality maintenance. For instance, maintenance was partially insured by the then-existing provisions of 40 CFR 51.18, which required each state plan to have adequate procedures to review, and where necessary prevent, the construction or modification of any stationary source of air pollution at a location where emissions from that source would result in interference with the attainment or maintenance of a national standard. Emission performance standards for new major stationary sources promulgated under section 111 of the Act and emission standards for motor vehicles promulgated under section 202 of the Act will also serve to mitigate the impact of growth. Moreover, a valuable tool to ensure maintenance exists in the requirements in section 110 of the Act that pollutants in the ambient air be continually monitored and that the Administrator shall call for the revision of inadequate state implementation plans whenever monitoring or other information indicates this to be necessary.

The Administrator determined, however, that such measures alone would not be adequate to ensure maintenance, particularly for pollutants emitted largely by motor vehicles in the context of increased use resulting from general urban and commercial development. Accordingly, the Administrator determined that the new source review procedures noted in the preceding paragraph should be expanded to cover not only stationary sources but also "complex" or "indirect" sources of air pollution—facilities which do not themselves emit pollutants, but which attract increased motor vehicle activity and thereby may cause violations of an implementation plan's transportation control strategy or may prevent or interfere with the attainment or maintenance of an ambient air quality standard.

Thus, all state implementation plans were disapproved on March 8, 1973, because of their failure to sufficiently assess and provide for maintenance of standards, and specifically for their failure to provide for the above-mentioned "complex" or "indirect" source review. In a separate action on March 8 (38 FR 6290), the Administrator issued an advance notice of proposed rulemaking stating his intention to modify his regulations for preparation of state implementation plans contained in 40 CFR Part 51 in order to give further guidance to the states in the preparation of approvable indirect source review measures. In a timetable approved by the D.C. Circuit Court, the Administrator then proposed such new guidelines on April 18, 1973 (38 FR 9599), and promulgated final guidelines on June 18, 1973 (38 FR 15834).

Specifically, these "guidelines" involved amendments to 40 CFR 51.11 and 51.18. Section 51.11 was amended so that a state implementation plan could not be fully approvable unless the state had legal authority to conduct "indirect" source review as well as "direct" (stationary) source review. Section 51.18 was amended to specify in detail the substantive and procedural matters which must be dealt with by states in developing approvable indirect source measures.

The Administrator noted in the April 18 preamble that even such a source-by-source review might not be adequate to assure area-wide maintenance: "The purpose of the review and determination procedures required under 40 CFR 51.18 [new stationary and indirect source review] is primarily to insure that the national standards will not be violated in the vicinity of a major new facility." The Administrator recognized that in the long run, greater attention to the overall impact of growth on regional air quality would be needed to fill in gaps left by a source-by-source review scheme.

In the June 18, 1973, final promulgation of the guidance regulations amending 40 CFR Part 51, the Administrator determined, in response to public comments, that a comprehensive growth analysis should be specifically required of the states in order to make the maintenance provisions of implementation plans fully acceptable. It was the Administrator's conclusion that indirect source review, while "a necessary addition" to an overall strategy for assuring maintenance, could be considered only an additional tactic in such strategy, "because source-by-source analysis is not an adequate means of evaluating, on a regional scale, the air quality impact of growth and development * * *" Furthermore, for pollutants such as hydrocarbons and nitric oxide, which affect air quality through complex atmospheric reactions resulting in the formation of photochemical oxidants and nitrogen dioxide, analytical tools that can be used with confidence to predict the air quality impact of a single source are not now available.

Accordingly, the Administrator promulgated additional regulations amending 40 CFR 51.12. States must comply with these regulations before their implementation plans can be regarded as fully approved with respect to air quality maintenance. Generally such regulations require states to identify by March 18, 1974, those areas that may exceed any national standards within the next ten years; to develop and submit to the Administrator by June 18, 1975, an analysis of the impact of projected growth on air quality in such regions; and to adopt such measures as may be necessary to assure that growth and development will be compatible with maintenance of the national standards. Only when such plans are finally approved can the Administrator consider the maintenance portions of state plans complete. Thus, indirect source review procedures are a necessary but insufficient element in a comprehensive strategy for air quality maintenance.

Further, in accordance with the order of the D.C. Circuit Court, the Administrator allowed States until August 15, 1973, to submit indirect source review procedures for approval. For those states which submitted nothing or whose plans could not be approved, the Administrator proposed on October 30, 1973 (38 FR 29893), Federal regulations for review of indirect sources. Since the public did not have adequate opportunity to comment on the seven plans that had been received by that date, no state indirect source procedures could be approved.

The Administrator is further required by the Court's order, as most recently modified on February 13, 1974, to promulgate final regulations no later than February 15, 1974. This rulemaking is, therefore, being carried out pursuant to the schedule approved by the D.C. Circuit Court in order to provide indirect source review procedures as one element in an overall strategy for maintenance which all state implementation plans are required to contain. State plans shall remain disapproved as to maintenance pending final submission and approval of the growth analyses and other necessary measures noted above.

Based on a preliminary review of the seven plans which had been submitted by October 30, 1973, three (Alabama, Florida, and Guam) appeared approvable and, thus, no proposal was made for those three States on October 30. The Alabama and Florida plans were proposed for public comment in the October 26, 1973, FEDERAL REGISTER (38 FR 24607–08) and the Guam plan as proposed on January 9, 1974 (39 FR 1454). In each case, the Administrator has reviewed the plan submissions to ascertain whether adequate legal authority exists, as required by 40 CFR 51.11, whether a public hearing was held, as required by 40 CFR 51.4, and whether the plan meets the detailed requirements for indirect source review contained in 40 CFR 51.18. The Administrator has also reviewed the written comments submitted in response to the proposals. Criticism of the submissions focused upon the size criteria for determining which indirect sources would be subject to review, the effective dates, and the failure to specifically address the issue of nondeterioration. Similiar comments were submitted with respect to the Administrator's October 30 proposal and are discussed in subsequent paragraphs of this preamble.

The Florida and Guam plans for indirect source review are fully approved below. The Alabama plan for indirect source review has been determined to be approvable in all respects except that the necessary public comment procedures were not included in regulatory form. The Administrator is, therefore, promulgating a corrective regulation for Alabama relating solely to public comment procedures. Since these procedures are clearly required by 40 CFR 31.18 and the regulation merely gives legally enforceable form to the procedures spelled out by the State in its submission, the Administrator finds good cause for promulgating such a correction without having proposed it.

To date, EPA has received 14 officially submitted state plans for review of indirect sources. Five (Connecticut, Kentucky, New Hampshire, Vermont and Virginia) have been or will shortly be proposed for public comment on their approvability and remain disapproved until the Administrator completes his evaluation. Seven of the state plans (Alabama, Idaho, Maine, New York, North Carolina, Oregon, and Washington) contain deficiencies which are specifically identified below. The Administrator is aware that several of these states are working to correct the deficiencies; if changes are submitted and found approvable, the regulations promulgated for these states will be revoked. Only the Florida and Guam indirect source review procedures can be fully approved at this time.

Modification to the Proposed Regulations Made in Response to Public Comments. Many individual citizens, environmental groups, corporations, commercial associations, and governmental agencies participated in the rulemaking process by submitting written comments or testifying at public hearings held on the October 30, 1973, proposed regulations. While it would be impossible to respond to every point, a number of the major comments are discussed below. Many of the alleged deficiencies in the basic approach of the proposed regulations as reflected in public comments were based upon an inadequate understanding of the purpose of these regulations. They are intended to provide one element in an overall strategy of air quality maintenance, including new stationary source review, new source performance standards, the Federal motor vehicle control program, and the comprehensive growth plans which the states must develop. As explained earlier, the Administrator has determined that a source-by-source review approach, while necessary to assure maintenance, must be accompanied by more inclusive long term growth analyses.

Many of the comments focused critically upon the size criteria for determining which indirect sources would be subject to the review process. One comment frequently made was that the sizes set forth (1,000 parking spaces, 20,000 vehicles per day for highways, etc.) were too large and that much smaller sources should be reviewed in order to assure maintenance. The Administrator has determined that the facilities to be reviewed should be limited to those most likely to cause air quality problems. In administering the Act, the Administrator must choose workable tactics considering sound and rational allocation of resources. In the Administrator's judgment, the relatively minimal benefits to be gained by reviewing smaller sources would be greatly outweighed by the resulting detrimental diversion of manpower and resources needed to implement other important aspects of the Act. Accordingly, it has been determined that air quality problems associated with an aggregation of smaller sources can be dealt with more effectively and efficiently through the comprehensive growth plans to be submitted by June 1975 than through source-by-source reviews under these indirect source regulations.

Several comments were also received from State agencies generally urging consideration of smaller size categories. As emphasized in the October 30 proposal, the size of an indirect source subject to these regulations has been determined in a nationwide context and cannot reflect special local conditions, such as a desire to include other environmental or social considerations in the review. The Administrator supports and encourages the enactment of more restrictive indirect source provisions and regulations by states where the needs, conditions, and/or public desire so indicate.

Other comments criticized the basic approach of reviewing facilities based upon strict size criteria such as size of associated parking areas. These comments made the point that size alone is not the determinative factor as to whether a particular facility will cause air quality problems; and that much more relevant factors concern trip inducement, the design of parking areas, the "tenant-mix" of shopping complexes, and others. Several of those who commented also construed the proposed regulations to mean that the principal purpose is to regulate the size of the associated parking lot. It should be emphasized that parking lot size is used only as a convenient, easily defined parameter which serves as a "triggering mechanism" for determining whether a source is subject to review. When a source is being reviewed under the regulations, factors relating directly to air quality impact will be utilized in making the final determination.

Several comments were received criticizing the use of a trip inducement test as being too indefinite a standard to use for determining whether a facility is subject to review. These comments pointed out that in many cases, a developer could not determine with confidence whether his facility is subject to review, since the trip inducement criterion requires that he estimate, several years into the future, how many vehicle trips his facility would induce during peak traffic conditions. Although many developers assess trip inducement as an integral part of their market analysis, a developer should not be placed in legal jeopardy should the actual trips induced upon completion exceed his initial calculations. The Administrator has concluded that a "trip inducement" review test would cause much uncertainty as well as substantial enforcement problems. Thus, the trip inducement standard is not included in the regulations promulgated below, with parking facility size being the only indicator of the need for review of sources other than highways and airports.

Some commentors criticized the regulations for not specifically addressing the problems of "non-deterioration." The agency proposed separate regulations for non-deterioration on July 16, 1973 (38 FR 18986). Due to the large number of comments received and the importance of this issue in relation to air quality, land use policies, and the country's economy, the Agency has not yet completed its rulemaking on non-deterioration. Because several basic approaches are still being considered, an attempt to reflect non-deterioration considerations in the indirect source regulations would be premature. However, it is EPA's intent that indirect source and significant deterioration regulations will be consistent with one another. Specific relationships will be addressed in regulation to be promulgated on significant deterioration.

Public comments also criticized the use of the distinction between "designated" and "non-designated" areas for determining the size of facilities which would be subject to review, on grounds that such distinction would violate the Act's intent that no significant deterioration of air quality be permitted in any area of the country, in that the division would purport to treat clean areas more leniently than dirty areas. As already stated, attempts to design these regulations to coincide with a "non-deterioration" policy would be premature. Moreover, the criterion for review in these regulations is whether the facility would interfere with attainment or maintenance of the national standards. Because of generally lower "background" levels in non-urban areas and in keeping with the purpose of these regulations, which is to review sources most likely to cause significant air quality problems, it is the Administrator's judgment that it is not necessary to review the same size source in non-urban areas as in urban areas.

In the regulations promulgated below, the use of "designated areas" for determining which areas of the country shall be subject to more restrictive source exemption provisions has been dropped and the Standard Metropolitan Statistical Area boundaries have been retained for this purpose. This is done to eliminate the confusion that could result if an area were designated as an air quality maintenance area (AQMA) for one pollutant but not for another. This should result in more areas of the country being subject to the lower cut-off limits than under the AQMA approach. In appropriate circumstances, the Administrator will consider requests by the States to use area designations other than SMSA's for determining the geographic applicability of the more restrictive exemption provisions.

With respect to highways, it is the Administrator's judgment that air quality problems would rarely be caused outside of urbanized areas. Highways generally connect one or more urbanized areas somewhere along their length and the regulation is written so as to focus the review on the most critical points along the highway, where the traffic volume and "background" concentrations are the greatest.

Many comments which criticized the size cutoffs for review as being too large argued that the regulations would encourage the development of many small facilities to escape indirect source review, thereby encouraging "urban sprawl" with resulting environmentally detrimental effects. It was urged by some that the Administrator should encourage rather than discourage some large developments such as regional shopping centers which, because they offer a consumer "one-stop" shopping for a large variety of goods and services, might actually result in a net decrease in area-wide vehicle miles of travel.

The Administrator certainly does not intend and does not believe that the encouragement of small, strip-type developments will be the effect of these regulations. First, it should be stressed that the primary purpose of the regulations is to ensure that proposed projects are designed and located in a manner consistent with air quality requirements. If the proposed project would interfere with a national standard, changes in the design, or extension of mass transit, should be considered. Only if a project cannot be made compatible with air quality requirements would it be necessary to prevent its construction. Furthermore, as long as there are economic incentives favoring development of large projects, the Administrator does not believe that developers of larger projects will change their scope of operations solely for fear of indirect source review. As is discussed below, developers will be encouraged to submit their plans for indirect source review at the earliest stage in the development process that the required information becomes available. Thus, applicants should be able to obtain guidance and a final determination from the reviewing agency at a point where total projected investment and expenditures for the source will be quite low, and will usually be able to make necessary design modifications so that a large indirect source can receive formal approval.

Some comments criticized the regulations for requiring analysis of only carbon monoxide effects for most sources and requiring photochemical oxidant, hydrocarbon, and nitrogen dioxide analysis only for highways and airports. Others stated that the highway cutoff numbers were too low to conduct adequate area-wide oxidant analysis for all highways subject to review. As stated in the preamble to the October 30, 1973, proposed indirect source regulations, it is the Administrator's judgment that adequate analytical techniques do not exist at this time to predict with confidence the effects of a single source on area-wide oxidant levels, except for extremely large sources which have an obvious area-wide impact on emission levels such as airports and large highways.

In the Administrator's judgment, using presently available analytical techniques, the impact on area-wide emission levels of hydrocarbon and nitrogen oxides resulting from all highway projects subject to review may not be sufficient to provide the basis for denial of an application. Therefore, the analysis with respect to photochemical oxidants and nitrogen dioxide for highways has been modified in regulations promulgated below. Only highways with an anticipated average annual daily traffic (AADT) volume of 50,000 or more vehicles per day, or modifications resulting in an increase of 25,000 vehicles per day, would be reviewed for their impact on photochemical oxidants or nitrogen dioxide. The regulation also provides that where a specific highway section is part of a roadway network which has been analyzed and found fully acceptable by EPA with respect to maintenance of the national standards for photochemical oxidants and nitrogen dioxide, then an oxidant or nitrogen dioxide analysis is not required for individual segments of such EPA-approved roadway network. The mechanism for EPA air quality analysis of proposed area-wide urban transportation plans and programs is established by the Federal Highway Administration (23 CFR Part 770), which provides that area-wide transportation plans be reviewed annually by the appropriate EPA Regional Administrator to determine their consistency with the approved implementation plan. This process is scheduled to be implemented by April 1, 1974.

Many comments criticized the June 13, 1974, effective date contemplated by the October 30, 1973, proposal as being an unjustified deferral. Others, however, argued that a longer time would be more appropriate. As explained in the preamble to the proposal, the deferral was considered necessary to allow state and local reviewing agencies adequate opportunity to make preparations for implementing the procedures prescribed by the regulations. (As will be explained below, while the regulation being promulgated today is written in terms of the "Administrator" performing the review, it is hoped that before the effective date, the Administrator will have delegated his reviewing authority to many state and/or local agencies or that the states will have submitted approvable procedures of their own.)

In light of recent firm Congressional guidance contained in amendments to the Clean Air Act included in the conference committee's version of the Energy Emergency Act (S. 2589), and in the report prepared by the Committee to accompany such amendments,[1] the Administrator has concluded that it is the intent of Congress that these regulations, with respect to parking facilities, not be applicable to indirect sources which have started construction prior to January 1, 1975. While the Congressional guidance does not apply to airports and highways, it is the Administrator's judgment that, for compelling administrative reasons and because of the need to improve the Agency's data base, reviews of airports and highways should also apply only to facilities which have started construction on or after January 1, 1975. The Administrator believes that such across-the-board deferred applicability is consistent with the analysis of growth presently contained in the implementation plans. Most implementation plans generally analyzed and allowed for growth at least until 1975, thereby making the implementation of these maintenance regulations most appropriate for the period after 1975.

The Administrator recognizes that many projects may presently be in the planning stages, but will not start actual construction until after January 1, 1975. If the Agency does not begin to implement the review procedures prior to

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[1] For further details as to the development of these amendments and the Administrator's response thereto, see 39 FR 1848, January 15, 1974. It should be noted that the January 15 notice announcing the deferral of the effective date of the indirect source review procedures does not affect the schedule established on June 18, 1973 (38 FR 15834), for designation of air quality maintenance areas and the analysis and development of control strategies for such areas.

January 1, 1975, developers of such projects would be in the difficult position of either continuing to commit money and effort to a project which might later require redesign or relocation, or suspending further work pending approval in 1975. To avoid such problems, the Administrator will begin to implement the review procedures on July 1, 1974, for any project which will commence construction after January 1, 1975, on a voluntary basis for those developers wishing to seek review. This approach is consistent with the recent Congressional guidance without producing inequitable delays or uncertainties for developers.

The deferral of the date for implementation of the review procedures until July 1, 1974, will allow the agency time within which to develop and publish general technical and design guidelines for distribution to applicants who will be seeking review under the regulations. Such guidelines will provide needed assistance to applicants in preparing the material required to be submitted by the regulation and in designing the traffic-related aspects of their sources so as to have the least possible adverse effect on air quality and the greatest possible chance for approval. The deferral will also allow greater opportunity for states to develop their own indirect source review procedures. Especially because these regulations inherently involve issues of land use, the Administrator feels that review should be carried out whenever possible at the state and local levels where land use decisions have traditionally been made.

Many comments were received regarding the approach to exempting projects at some stage in the development short of the commencement of actual construction. The proposed regulation provided that an applicant who had entered into a "general construction contract" prior to the effective date would not be subject to review.

Some comments criticized this approach as being open to loopholes in that applicants who had spent very little time or money on development and who did not plan to do so until well after the effective date could escape review by entering into a contract. The proposal was also criticized on the grounds that much costly physical work could have already begun on a site in preparation for a specific project design, and yet because the "general construction contract" for the actual superstructure had not yet been executed on the effective date, the project would be subjected to the uncertainties of review.

In reevaluating this issue based upon the public comments, the Administrator has determined that the "general construction contract" concept should be dropped as being too susceptible to abuse by those seeking to avoid review. At the same time, the Administrator has decided to define the phrase "commence construction" in the regulation to clarify the stage a project would have to reach on the effective date in order to be exempt from review. Under the clarifying language, where actual physical on-site construction or other physical site preparation work as part of a continuous program for the completion of a specific indirect source has commenced before January 1, 1975, an indirect source will not be subject to review.

The Administrator considers this to be the most rational and equitable approach. To draw the line at a later stage in construction could be quite economically disruptive, while to draw the line at an earlier stage could exempt many projects from review which could still relatively easily and inexpensively be modified in concept and design in order to comply with this regulation.

Public comments were received urging that any indirect source otherwise subject to review under the regulation, which is constructed pursuant to an urban renewal or redevelopment plan, be exempted from review so long as a redevelopment agency had begun to carry out the project. Under this approach, a major indirect source for which construction will not commence for several years would escape review even though such source could adversely impact air quality if it is not designed properly.

The Administrator recognizes that urban renewal and redevelopment projects can, if properly planned, have a very positive effect on area-wide air quality and on the overall quality of the environment. However, it would not be consistent with the purpose of the Act or these regulations to allow any major indirect source subject to these regulations and which commences construction on or after January 1, 1975, to be exempt from review. As has been noted, the basic focus of the review process in these regulations is to ensure that localized violations of the carbon monoxide standards will not be created in the vicinity of a specific indirect source. It is the Administrator's desire to protect the health of individuals living and working in urban renewal areas to the same degree as all other individuals.

Moreover, the Administrator feels that any disruptive effect on urban renewal projects caused by these regulations should be minimal. Indirect sources for which on-site grading or construction work is begun before January 1, 1975, will not be subject to review. For those sources that will be reviewed, it should again be stressed that the primary emphasis of these regulations is to ensure that facilities will be designed properly in accordance with air quality considerations. It should be necessary to deny an approval only in unusual situations where it is impossible to construct a facility with design or other traffic-related conditions imposed so as to meet the tests for review.

One comment questioned whether EPA has legal authority to promulgate requirements for review of indirect sources. The Administrator feels strongly that such authority is conferred by section 110(a)(2)(B) of the Act, which requires that implementation plans include "such other measures as may be necessary to ensure attainment and maintenance of such primary and secondary standards, including, but not limited to, land use and transportation controls". Moreover, section 301(a) of the Act provides that "The Administrator is authorized to prescribe such regulations as are necessary to carry out his functions under this Act." As has been explained earlier in this preamble, the Administrator has determined that review of the air quality impact of indirect sources and the prevention of their construction or modification at such locations where air quality violations could be created and perpetuated is a necessary element in an overall strategy to assure maintenance of national ambient standards as mandated by the Act.

Another issue which has been raised is that while these regulations purport to limit the parking lot size of many facilities, local ordinances may require a certain ratio of parking spaces to square feet of commercial space before certain types of facilities may receive local building permits. The Administrator feels that problems arising from this situation will be minimal. First, the regulations should not in most cases operate to limit the sizes of parking facilities, but merely assure that traffic-related aspects of an indirect source are properly designed in accordance with air quality considerations. Second, to the extent that accommodations must be made under the regulations, such as arranging for the extension of mass transit to a facility and diminishing the number of planned parking spaces, developers may be able to obtain variances from local requirements on the basis that Federal regulations would otherwise prevent the construction and that the purpose of the local parking requirements will be served by the provision for additional mass transit.

It should be understood that the fact that these regulations impose one more step in the approval process and may further restrict an owner's freedom of action relating to parking facilities does not make the regulations improper in view of their necessity under the Act to help assure maintenance of health standards.

Another issue which has created some confusion and has been raised in public comments revolves around previous statements made in earlier preambles that these regulations relate to the attainment, as well as the maintenance, of the national standards. The primary purpose of the regulations is to serve as an element in an overall strategy for maintenance. The regulations are not technically part of any control strategy to attain the standards in those areas in which the ambient air standards are now being exceeded. Nevertheless, they will serve a useful corollary purpose of assisting in the attainment of the standards in such areas.

Several questions were raised concerning the applicability of the proposed regulation in relation to housing developments and airport roadways and parking lots. The regulation is not intended to apply to single family housing developments; however, apartment house developments meeting the "associated parking area" criterion would be subject to review. In the Administrator's judgment, a single family tract development does not produce sufficient emission density to yield meaningful results for an air quality impact analysis of an individual development. This is not to say that low density development is more desirable than high density development; however, it is the Administrator's judgment that such low density development is more appropriately and effectively analyzed and dealt with in the comprehensive growth plans related to air quality maintenance.

With respect to airport roadways and parking facilities, the Administrator feels that it is appropriate to review such facilities for their localized impact on carbon monoxide concentrations as well as to review their impact when conducting general airport review for area-wide impact on carbon monoxide, photochemical oxidants, and nitrogen dioxide concentrations.

There was some concern expressed over the possible misinterpretation of the wording "or combination thereof" included in the definition of indirect source, since it might be construed that several different developments would be considered a single indirect source. This wording has been omitted from the regulation promulgated below, since it is unnecessary and has caused needless confusion. This deletion will not in any way change the intended scope of these regulations.

Several comments criticized the basic approach of the regulations as requiring approval decisions to be based solely on air quality considerations, ignoring social and economic considerations. Economic and social considerations have not been ignored in developing these regulations. As has already been explained, the Administrator has taken the question of economic disruption into consideration in determining the stage of development a project must reach in order to be exempt from review on the effective date. Also, it should be stressed that the purpose of the regulations is not to preclude development except in those rare cases in which no accommodation with air quality maintenance can be reached. Furthermore, these regulations are one of the measures necessary to assure maintenance of the primary standards for auto-related pollutants. These primary standards are set to protect the public health, certainly an overriding social concern.

It is true that a final determination as to a specific source's approvability under the regulation must be based solely on air quality factors. To do otherwise would exceed the scope and purpose of these regulations promulgated pursuant to the Clean Air Act. It should be emphasized, however, that the determination made pursuant to these regulations is only one necessary step among many other land-use measures already generally established (i.e., zoning approval, site plan approval, demolition and building permit approval, sewer tap-in approval, etc.) in order to assure that a specific facility will be designed and located in a manner not inconsistent with the public health, safety, and welfare. It is hoped that indirect source review will eventually be incorporated into comprehensive State and local land use planning processes so that social, economic, and air quality factors can be considered in an integrated manner.

Many comments were received regarding the procedural aspects of information submitted with application, public comments, and agency determinations. In response to comments, the regulation has made clear that the reviewing agency may require for submission only that information reasonably related to an air quality analysis, and that the time for public comment will not begin to run until all information has been submitted. Also, in response to comments, the regulations now provide that the period within which decisions must be made may be lengthened to allow for more time to make often complex and difficult technical decisions based upon possible voluminous material and public comments.

Several other comments relating to the procedures are inappropriate for consideration at this time since the procedures basically follow the requirements of the Administrator's own regulations appearing in 40 CFR 51.18 which were finally promulgated after proposal and a public comment period on June 18, 1973.

Developers are encouraged to apply for review under these regulations as early in the development process as the information required to be submitted can be prepared. Thus, applicants will be able to ascertain whether their plans will be acceptable under the regulations well before substantial sums are expended in relation to total project cost. The Administrator also encourages developers to seek review of entire large scale projects, such as redevelopment projects, industrial parks, or planned communities, even though only certain elements of such projects might be subject to review under this regulation. Approval of the project as a whole will allow the developer to proceed with certainty that the entire project can be completed as planned.

The language concerning modifications to design and conditions for approval has been modified in response to public comments to make clear that the reviewing agency is under no affirmative duty to devise alternatives which will make an otherwise disapprovable project approvable, but is merely given the discretion to do so or to consider alterations suggested by applicants. The conditions which might be imposed on a permit have been clarified to ensure that they must relate to air quality, and that they may be imposed only if the facility could not meet approval in the form proposed by the application.

Several comments suggested that the relationships of the indirect source regulations to "management of parking supply" regulations promulgated by the agency as part of several regional transportation control plans be explained so as to avoid confusion among applicants and reviewing agencies as to which regulation would be applicable to a particular facility. In this regard, it should be pointed out that in the preamble to the proposed indirect source regulations, it was stated that in areas where transportation control plans are required, review of smaller indirect sources would be justified.

In regard to the "management of parking supply regulations" the Administrator has recently deferred the effective date for review until January 1, 1975, in all areas where such regulation was promulgated for the reasons set forth in the preamble to such action printed at 39 FR 1848, January 15, 1974. As explained in that preamble, the agency will be reexamining such regulations in the next few months and will be making other studies relating to transportation control plans in general.

In view of the fact that the indirect source regulations will be applicable only to facilities commencing construction on or after January 1, 1975, and that several aspects of transportation controls are actively under consideration, the Administrator has determined that it would be inappropriate to tailor the indirect source regulations in regard to transportation plan considerations at this time. The Administrator will clear up any confusion relating to "parking management" regulations well before January 1, 1975. At this time, it should be assumed that the review for smaller sources in the transportation control plans will remain unchanged.

Delegation of Review Responsibility to State and Local Agencies. The proposed regulation has been changed to specify that the "Administrator" or an agency designated by him, is designated as the reviewing authority. In the preamble to the proposed regulations, it was noted that a state or local agency could be designated to carry out the review under EPA's promulgated regulations on the basis of an EPA regulation [40 CFR 52.02(d)] which provides that provisions of an approved or promulgated implementation plan may be enforceable by states and local agencies in accordance with their assigned responsibilities under the plan. It was also stated that where states were unwilling to carry out the review under EPA regulations, the EPA would assume this responsibility.

Several states have thus far indicated their willingness to carry out such review, others have indicated that they would not, and many have not indicated their position with certainty on this issue. In view of the deferred effective date for these regulations, the Administrator considers it most appropriate at this time to delay designating state or local agencies to carry out review until a more complete nationwide consultation with state and local agencies can be made to ascertain precisely which agencies should be delegated the authority to conduct review. The Administrator continues to encourage state and local agencies to seek such delegation through the appropriate EPA regional office.

In this regard, the Administrator emphasizes that the Clean Air Act places primary responsibility for the prevention and control of air pollution on the states and local governments. Accordingly, two broad options are available to states in designating an agency to exercise the review authority required under these regulations. One option is to place responsibility for review of indirect sources in a state-level agency; the other option is to assign responsibility to appropriate units of local government.

Because of the impact which projects to be reviewed under these regulations may have on land use and urban growth and development, the Administrator encourages the states to delegate substantial authority under these regulations to appropriate local governmental units. Such delegation ought to be subject to appropriate conditions (such as effective and coordinated review on the appropriate regional scale, citizen involvement, ultimate control by general purpose local government, etc.) Alternatively, the Administrator encourages the states to allow local general purpose governments, subject to similar conditions, to request designation of a local governmental agency as the reviewing authority. If a state chooses to exercise review authority at the state level, the Administrator encourages states to provide for consultation with affected local governmental units in conducting such reviews. Although the Administrator feels that delegation of review powers to State authorities, with their subsequent subdelegation to local authorities, is the most rational means of delegating responsibility in accordance with the framework of the Act, the Administrator reserves the right to delegate such review powers directly to local governmental units in appropriate cases, where localities are willing to accept such responsibility and States are not. It is also possible to delegate review under this regulation directly to State or local administrative agencies. However, such delegation will not be done without the consent of the elected officials having jurisdiction over such agencies. Whenever a state or local agency requests delegation of these review procedures, the Admisintrator will consider appropriate administrative or procedural modifications to the regulation, consistent with the Act and 40 CFR Part 51, to facilitate such assumption of responsibility.

The Administrator also is aware of the concern some have voiced that the review authority may be assigned to an agency whose authority is restricted to air pollution control. Accordingly, the regulations require that, where the designated agency does not have continuing responsibilities for land use planning and decision making, the reviewing agency shall consult with the appropriate state and local agency or agencies prior to making certain determinations. In turn, if the designated review agency is not an air pollution control agency, the regulations require that the review agency shall consult with the appropriate state and local air pollution control agencies prior to making its determination.

While the Administrator urges States and/or localities to accept the responsibility to conduct review under these regulations as the Administrator's agent, it should be stressed that the Administrator even more strongly encourages States to develop their own indirect source review procedures in accordance with the requirement of 40 CFR 51.18. Through this process the States can more fully tailor regulations to their own special needs, and the Act's emphasis on State and local control of air pollution will be more fully served.

Additional Changes to Proposed Regulation. The final regulations clarify the information which must be submitted by the applicant. Generally, the applicant is not required to analyze the air quality impact of his facility; this function will be performed by the reviewing Agency based on data submitted by the applicant. Since developers normally do not have the expertise to perform such an analysis, this change will ensure that such calculations are properly made, and that the air quality estimates will be made at receptor locations considered important by the reviewing agency.

It should be emphasized at this point that much of the data required of the applicant may be available in an Environmental Impact Statement (EIS) prepared pursuant to the National Environmental Policy Act (42 U.S.C. 4321) or similar state legislation. It is not the intent of this regulation to duplicate the information-gathering requirements of NEPA. Where an EIS has been prepared, it should be submitted as part of the application and only the required information not contained in the EIS need be submitted separately.

The final regulation has been modified to clarify the findings the reviewing agency must make before an application can be approved. For facilities other than airports and highways, the reviewing agency is authorized in appropriate cases to make the judgment concerning interference with attainment or maintenance of the national standards on the basis of whether the construction or modification will result in traffic flow characteristics which have been determined by the Administrator not to cause violations of the national standards for carbon monoxide. This provision does not modify the reviewing agency's responsibility to make the determination that the ambient air quality standards will be attained and maintained; it simply provides another tool to be used in appropriate situations for making such a determination. In cases where the Administrator finds that the use of the traffic flow characteristics would not be compatible with the tests for review under the regulation, he is required to consider a diffusion model is making his final determination. In cases where the developer does not believe that the traffic flow characteristics prescribed by the Administrator's guidelines are necessary in order to ensure attainment and maintenance of the national standards for carbon monoxide, the developer may submit with his application the results of a diffusion model to support his contention.

Prior to the effective date of these regulations, the Administrator will publish guidelines setting forth the traffic flow characteristics which must be attained for various types of facilities in order to prevent localized violations of the carbon monoxide standards. These guidelines will be used by the Administrator (and designated agencies) in carrying out the review under the regulations and should be used by developers in planning their facilities so as to maximize their chances for approval. This guidance will also include information on sound design practices (e.g., parking lot design, means for ensuring adequate gate capacity, methods for reducing the levels of service on roadways and intersections significantly affected by the indirect source) and other measures, such as mass transit options, which may be used to attain the appropriate traffic flow characteristics.

The above approach is intended in appropriate cases to translate the required air quality determination into specific performance criteria with which developers are much more familiar. This approach minimizes the controversial land use implications of these regulations by emphasizing the control of adverse traffic conditions which cause highly localized carbon monoxide concentrations. Thus, even though the national standards for carbon monoxide may presently be exceeded at some locations in a region, most facilities subject to this regulation which are designed to produce the requisite traffic flow characteristics should still be allowed to construct. This is due to a combination of three factors:

1. Generally, present air quality data reflect the most highly polluted downtown areas. Much new construction occurs on the outskirts of the urban area where carbon monoxide concentrations are relatively low. Construction that does occur in downtown areas is usually served or can be served by mass transit so that the induced traffic will be minimal.

2. The Federal Motor Vehicle Control program will continue to reduce automobile emissions. By the date a facility that commences construction on or after January 1, 1975, is completed, ambient air quality levels of carbon monoxide should be significantly lower than they are presently.

3. To the extent that air quality levels at the site of a proposed indirect source are expected to continue to threaten the national standards, this condition may be due to existing adverse local traffic conditions which may be corrected. If such a situation is corrected, a facility may be allowed to construct if the owner can demonstrate that the additional induced traffic will not cause the local traffic flow to return to its initial condition.

The final regulations do not require an air quality impact analysis for indirect sources with associated parking areas beyond the first year after the source is fully operational. It is the Administrator's judgment that increased carbon monoxide emissions due to growth of mobile source activity associated with a specific indirect source (other than a highway or airport) would be more than offset by the Federal motor vehicle control program. Moreover, to be consistent with the basic approach of these regulations, the Administrator feels that potential problems from increased traffic in the vicinity of a parking-related source which may be caused by overall community growth should be dealt with in the maintenance plans to be developed by the States. The ten-year analysis of airports and highways is still required, since the growth of mobile source activity associated with these sources may be sufficient to offset the effect of the Federal motor vehicle and aircraft control programs. For example, the analysis for airports must include not only the growth associated directly with the airport, but other commercial and industrial development occurring within three miles of the airport.

The final regulation clarifies the circumstances under which the reviewing agency may condition permits and eliminates the responsibility for the post-construction air quality monitoring by the applicant. If needed, such monitoring should be conducted by the reviewing agency. The conditions placed on a permit are limited to those measures which are necessary to ensure that air quality standards are attained and maintained.

A new paragraph (10) has been added to encourage the reviewing agency to specify the extent to which a facility could be further modified without being subject to review. This provision was added to deal with a situation in which the reviewing agency determines that even a fairly minor modification, which would not otherwise be subject to review under the regulation, could cause a violation of the national standards.

A new paragraph (12) has been added invalidating an approval to construct if the construction is not commenced within 18 months (subject to extension where justified) after receipt of approval. This is to ensure that changed conditions in the vicinity of the proposed facility would not invalidate the air quality impact calculations on which the original approval was based.

New provisions have been added to clarify responsibilities for review of Federal facilities in cases where the Administrator delegates the authority to State or local agencies to implement the indirect source review procedures. Recent court decisions and Presidential Executive Order 11752 (38 FR 34793, December 19, 1973) cast doubt on the authority of States to subject Federal facilities to permit controls. It is, therefore, necessary for the Administrator to retain responsibility for review of all Federal facilities subject to this regulation in order to carry out the provisions of Section 118 of the Act, which makes clear that Federal facilities must be subject to air pollution controls to the same extent as non-Federal facilities. (It should be noted, however, that the court decisions and Executive Order 11752 do not limit the application of State and local substantive standards and emission limitations to Federal facilities.)

Since these regulations will not be implemented until July 1, 1974, for sources commencing construction on or after January 1, 1975, the Administrator feels that it would be appropriate to allow additional written comments to be submitted in response to the promulgated regulations. All comments postmarked not later than April 1, 1974, will be considered, and where appropriate, revisions may be made to the regulations. Comments should be submitted in triplicate to the appropriate EPA Regional Office and labeled as "indirect source comments" on the envelope. Those who submitted written comments in response to the October 30 proposed regulations are encouraged to incorporate relevant portions of such previously submitted comments by reference into their new comments wherever the same point is being made.

The Administrator again strongly encourages States to utilize the time allowed by the deferred effective date to develop and submit their own indirect source review procedures, since the Clean Air Act emphasizes that States and local governments are to have the primary responsibility for the control of air pollution and because decisions involving local land use are traditionally more appropriate for State and local consideration.

As discussed above, the effective date of these regulations will be July 1, 1974, and they will be applicable to indirect sources commencing construction on or after January 1, 1975.

(Sections 110(a)(2)(B), 110(c), and 301(a) of the Clean Air Act, as amended (42 U.S.C. 1857c–5(a)(2)(B), 1857c–5(c), and 1857g(a)))

Dated: February 14, 1974.

RUSSELL E. TRAIN,
Administrator.

federal register

TUESDAY, JULY 9, 1974
WASHINGTON, D.C.
Volume 39 ■ Number 132

PART II

THE NATIONAL ARCHIVES OF THE UNITED STATES • 1934 •

ENVIRONMENTAL PROTECTION AGENCY

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AIR PROGRAMS; APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS

Review of Indirect Sources

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 52—APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS

Review of Indirect Sources

On February 25, 1974 (39 FR 7270), the Administrator of the Environmental Protection Agency (EPA) promulgated an indirect source review regulation (40 CFR 52.22(b)) to be incorporated into the Clean Air Act implementation plans for 52 states and territories. As a followup to that regulation, the Administrator is today taking the following actions:

(1) In the preamble to the February 25 promulgation, the Administrator noted that additional written comments would be accepted until April 1, 1974, and that where appropriate, revisions may be made to the regulation (39 FR 7276). Many interested persons submitted written comments. The Administrator has considered the comments and has determined that several amendments of a clarifying, procedural nature are warranted. These amendments are being published today.

(2) The Administrator will respond in this preamble to significant new general comments which were not dealt with in the February 25 preamble.

(3) The Administrator has noted that some confusion exists as to the intended scope and application of the regulation and as to other matters relating to interpretation of the regulation. An explanation responding to frequently-raised questions of interpretation is provided in this preamble and in a new Appendix A to Part 52.

(4) Further information is provided regarding procedures to be followed in conducting review under the regulation and regarding delegation of review responsibilities to state and/or local agencies.

NEW GENERAL COMMENTS

Because many general comments directed to the wisdom of the basic scheme of the regulation have already been addressed in the February 25 preamble, the Administrator does not feel it is necessary or helpful to respond to them again. Nevertheless, there are three points the Administrator would like to make in response to the new comments.

1. *The need for the regulation.* One major retailer submitted lengthy comments challenging the entire concept of indirect source review for shopping centers because the Administrator allegedly has not adequately established that such a regulatory scheme is necessary to assure maintenance of the ambient standards for carbon monoxide. In an attempt to show that such a regulation is not necessary with regard to shopping centers, the retailer submitted two studies.

One was an empirical study showing that after several days of monitoring at one shopping center, no violation of an ambient carbon monoxide standard could be found. This study involved "grab bag" sampling at various locations over the entire shopping center parking lot, and emphasized averaging the sample values over all locations for each hour and over all hours for each location. Such an averaging procedure is inconsistent with the method in which the air quality standards are prescribed. Air quality values should be averaged for discrete one and eight hour periods at each location, not over all locations. Although the study includes some continuous monitoring, carbon monoxide concentrations were not monitored in close proximity to the most frequently used exit/entrance, the site where the highest concentration would be likely to occur. Moreover, the study confined itself to analysis of air quality on the site of the shopping center, whereas more significant impacts can be created at nearby intersections.

While it is true that a shopping center may be constructed such that there would be no reasonable receptor sites in the close proximity to the areas where the highest concentrations would be likely to occur, it is not appropriate to generalize that a source category does not have a significant impact on air quality without studying its impact at the points of highest concentration, including nearby intersections, and under the worst conditions.

The other study dealt largely with the impact of various types of shopping center developments on area-wide emission rates. Such analysis is irrelevant to the question of whether localized carbon monoxide problems can be caused by vehicles attracted to a shopping center. This study also indicates, through the use of predictive models, that by 1980 various types of shopping center developments would not cause carbon monoxide violations due to the effects of the Federal Motor Vehicle Control Program. A prediction of the impact of an indirect source on ambient air in 1980 is unresponsive to the problem at hand since ambient carbon monoxide standards are to be met under the Clean Air Act as expeditiously as practicable but not later than the statutory attainment date, which is in most cases 1975 and in no event later than 1977.

The Administrator has conducted a number of studies to determine the impact of various types of indirect sources on ambient air quality, including shopping centers [1,2] and sports stadia.[3] Even though the studies were conducted over a limited time period, the facilities were found to have a definite adverse impact on ambient carbon monoxide levels, and even to cause violations of the national standards. These results substantiate the need for procedures to review such sources prior to construction in order to protect the public health.

The Administrator has never contended that every indirect source subject to review will necessarily cause air quality violations. If such were the case, then the proper course of action would be to promulgate an absolute ban on further construction of such sources. Rather, the Administrator has determined that in certain circumstances indirect sources can create ambient violations or exacerbate existing violations. Even in circumstances where the construction of one source in an area might not create violations, the subsequent construction of one or more additional sources in the near vicinity could do so.

Since implementation plans under the Clean Air Act must contain measures to "insure" that the ambient standards will be attained and maintained, and since the Administrator has determined that indirect sources, singly or in combination, can cause violations of the standards, it is necessary for implementation plans to contain procedures for preconstruction review of such sources. The Administrator has confidence that the Federal Motor Vehicle Control Program being implemented pursuant to Title II of the Clean Air Act will continue to diminish the levels of ambient carbon monoxide. However, such reductions will not in the Administrator's judgment suffice to prevent ambient violations in the vicinity of indirect sources subject to the regulation for at least the next few years.

Some have questioned whether it is proper to promulgate this review regulation even in areas which now have no carbon monoxide problem. The relative cleanliness of a particular area's air is irrelevant to the question of whether indirect source review is necessary for that area, since a new indirect source (or several new sources) could easily convert almost pure air into air violating the public health standards. The primary purpose of the regulation is to assure maintenance of the ambient standards—to assure that no violations will occur where none now exist.

2. *Approval based solely on air quality factors.* A widespread misunderstanding of the purpose and effect of indirect source review is reflected in the following comment made by a national association:

> According to the indirect source regulations, design characteristics, location and timing of future development is being based solely on air quality factors. We feel that no single factor should be the sole determinant of land use planning decisions.

The indirect source regulation does not make air quality the "sole determinant" of land use planning decisions except in an area which is now totally free

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[1] GCA Corporation, "Validation Study of an Approach for Evaluating the Impact of a Shopping Center on Ambient Carbon Monoxide Concentrations", Contract No. 68-02-1376, Task Order No. 2 for EPA (March 1974).

[2] Quality Assurance and Environmental Monitoring Laboratory, Field Monitoring and Instrument Branch, "Carbon Monoxide Measurements in Vicinity of Shopping Centers," RTI Report, Contract No. 68-02-0294, Task Order No. 3 for EPA, (April 1973).

[3] Bach, W. D., Crissman, B. W., Decker, C. E., Minear, J. W., Raspberry, P. P., and Tommerdahl, J. B.: "Carbon Monoxide Measurements in the Vicinity Of Sports Stadiums," RTI Report, Prepared for EPA Under Contract 68-02-1096, Task No. 1 (July 1973).

of any zoning or other land-use regulations. As the Administrator explained in the February 25 preamble:

> It should be emphasized * * * that the determination made pursuant to these regulations is only one necessary step among many other land-use measures already generally established (i.e., zoning approval, site plan approval, demolition and building permit approval, sewer tap-in approval, etc.) in order to assure that a specific facility will be designed and located in a manner not inconsistent with the public health, safety, and welfare. It is hoped that indirect source review will eventually be incorporated into comprehensive State and local land use planning processes so that social, economic, and air quality factors can be considered in an integrated manner. 39 FR 7274 (February 25, 1974).

The fact that one of many permits and approvals a facility must obtain before construction relates solely to air quality certainly does not make air quality "the sole determinant" of land use planning.

3. *Analysis Beyond One-Fourth Mile.* Additional comments indicated that the air quality impact of an indirect source should be examined at distances further than one-fourth mile from the source. It should be noted that the tests specified in subparagraphs (4) and (6) in no way restrict the Administrator as to the location of the air quality impact analysis. However, it is the Administrator's judgment that the major impact of most facilities with respect to carbon monoxide will be within one-fourth mile of the facility; accordingly, the detailed traffic data that must be submitted as part of each application is limited to the immediate vicinity of the indirect source. It is the Administrator's intent to request more comprehensive data pursuant to subparagraph (3)(i)(*i*) on a case-by-case basis, and to analyze the air quality impact at distances beyond one-fourth mile in cases where the facility might pose a threat to the air quality standards at such locations.

Explanation of Frequently-Raised Questions of Basic Interpretation. The purpose of the following discussion is to set forth certain basic interpretations of the regulation in order to clarify confusion reflected in public comments and questions. In addition, a new Appendix A to Part 52 is being published simultaneously with this rulemaking setting forth the substance of the following discussion in interpretative ruling form. As is true with any statute or regulation, it is impossible to answer definitively every conceivable question of interpretation or application which might arise in implementing the regulation. Just as courts frequently decline to decide certain issues until an actual situation presents a specific case or controversy before them, the Administrator believes that it would be unwise to answer every hypothetical question of interpretation or application raised in the comments because of the precedent that could be set based upon inadequate factual information. There are some questions of interpretation which will have to be resolved on a case-by-case basis in the process of implementing the regulation.

The explanation offered below relates to points so basic that if they were not clearly understood by the public and agencies implementing the regulation, serious mistakes in implementation might occur. One caveat should precede the discussion: The following is the Administrator's interpretation of his own regulation, 40 CFR 52.22(b). States which develop their own regulations which may be approved under 40 CFR 51.18 are not bound to interpret their regulations in the same manner, so long as their regulations operate to insure that ambient air quality standards will not be violated as a result of the construction of a new indirect source.

Most questions relate to the basic scope of the regulation, the type of indirect source which is subject to review, and the nature of the "associated parking area" concept. Since almost no comments or questions of interpretation were received regarding highways and airports, the following discussion, unless otherwise noted, deals with all other types of indirect sources.

The basic focus of the regulation is to review a new facility which will have an associated parking area of the requisite number of parking spaces. The list contained in 40 CFR 52.22(b)(1)(i) is merely a set of examples and should not be over-emphasized. The key to determining which facilities must be reviewed is in paragraph (b)(2), which requires review of "a new parking facility, or other new indirect source with an associated parking area" of the requisite size. Thus in every case, the most important factor will be to determine whether an "associated parking area" of the requisite size is to be "owned and/or operated in conjunction with" a facility.

An "associated parking area" is defined in paragraph (b)(1)(iii) as a "parking facility or facilities owned and/operated in conjunction with an indirect source." To be an "associated parking area" within the intent of the regulation, the area must be a separate and discrete localized facility associated with a particular indirect source. Thus, to clear up much confusion reflected in the written comments, an urban renewal area is not itself an indirect source subject to review under the regulation merely because within the entire area there may be more than 1,000 parking spaces. Rather, it is necessary to look at discrete parking facilities within the urban renewal area to determine what, if any, construction within the area will be subject to review under the regulation.

For example, assume that twelve blocks of a city are being reconstructed pursuant to a redevelopment plan. Within the twelve blocks, there is to be a municipal auditorium with 1,500 parking spaces underneath it, an apartment building with 300 parking spaces adjacent to it to serve the residents, a 1,200-space municipal parking garage, many townhouses with single or double private garages for the use of their owners, and 500 spaces for curb-side on-street parking.

If such twelve blocks were within an SMSA, the municipal auditorium and the municipal parking garage will each be subject to the regulation as a separate indirect source since each will have a separate and discrete associated parking area of 1,000 spaces or more. The redevelopment project itself is not an "indirect source" subject to review under the regulation, however, merely because it includes in the aggregate more than 1,000 spaces.

Thus, to answer another point which has caused confusion, the construction, 5 years later, of a new apartment building with an associated parking area of 600 cars within the urban renewal area will not by itself trigger review under the regulation. First, this is not a "modification" within the contemplation of paragraph (b)(2)(i)(b) since it is not a modification of an associated parking area but rather a new separate and discrete parking area. Second, this is not an increment under paragraph (b)(2)(iv) since it is not an increment to an existing "indirect source" within the contemplation of the regulation.

If 500 spaces are later added to the apartment's parking facility, then this is a modification to a particular facility which triggers review. Similarly, additional spaces added to such facility from time to time will be considered as increments to that facility within the contemplation of paragraph (b)(2)(iv).

The foregoing also applies to other large-scale developments such as industrial parks, new towns, and large subdivision developments. These types of developments are not in and of themselves indirect sources subject to review under the regulation, although in each case they may contain many indirect sources subject to review.

An understanding of this concept helps answer other questions raised in public comments. For instance, a question frequently posed is whether commencing construction of one facility within an urban renewal area before 1975 will exempt all future construction in the area from review. The answer is "no". The urban renewal area is not itself an indirect source; facilities within the area which have associated parking areas of the requisite size are. Thus construction of a second facility within the area after December 31, 1974, which is otherwise subject to review under the regulation will not be exempt merely because other facilities commenced pursuant to a common plan were exempt.

The reason the phrase "or facilities" is included in paragraph (b)(1)(iii) is to assure that mere physical barriers between parking areas serving a single indirect source will not operate to exclude from review what is in essence a discrete associated parking area for a single source. For instance, a shopping mall which is to be constructed with 500 parking spaces on the north side of the mall and 500 spaces on the south, even though the two parking "facilities" are physically separate and do not have connecting roads between them, will be considered to have an "associated parking area" of 1,000 spaces.

Several questions have been raised regarding the phrase "owned and/or operated in conjunction with an indirect source" contained in paragraph (b)(1)(iii). The use of the word "owned" does not mean, as some who commented apparently feared, that a parking lot a particular developer owns in Tallahassee will be counted in determining the size of an associated parking area in Peoria. The key phrase is "in conjunction with," which is intended to convey an operational test looking to whether a particular parking area serves a particular facility under a common scheme of ownership and/or operation.

Parking facilities which are fortuitously constructed near an indirect source but over which the owner or operator of the source has no control, and which are not constructed pursuant to an understanding by which the facility will serve the indirect source, will not be considered an "associated parking area" of the source. For instance, if a developer constructs a shopping center with 600 parking spaces and a municipality erects a 500-space parking garage adjacent to the center completely independent of the shopping center development, there is not a single, 1100-space associated parking area within the contemplation of the regulation. However, if such parking garage were constructed pursuant to an explicit or even implied agreement with the shopping center developer to serve the shopping center, it would be considered part of the center's "associated parking area."

It is not necessary for an "associated parking area" to be directly contiguous to an indirect source to cause that source to be subject to review. For instance, a developer could not avoid review by constructing a large retail facility on one side of the street with forty parking spaces immediately adjacent to it, and constructing a 960-space parking facility across the street. All 1,000 spaces will be treated as an "associated parking area" within the contemplation of paragraph (b)(1)(iii) since they are owned and/or operated in conjunction with a particular indirect source. On the other hand, parking facilities located across the street from each other within an industrial park which serve two separate indirect sources will not constitute a single "associated parking area."

Many questions have arisen concerning "phased" development. As noted above, a major area-wide development such as an urban renewal project, an industrial park, or a "new town" will not be an indirect source itself but may instead contain several indirect sources separately reviewable under the regulation. In response to many comments, two points about phased development should be made clear at this time:

(1) Applicants will be able, and in fact are encouraged, to apply for approval of all indirect sources within their phased developments at the same time, so long as all the information required for the reviewing agency to perform an air quality impact analysis for each source can be provided. This will allow developers to proceed with major developments with a greater degree of certainty.

(2) Since a major area development is not in itself a discrete indirect source subject to review under the regulation, commencement of one phase of such development prior to 1975 will not operate to exempt subsequent indirect sources within such overall development plan which commence construction after December 31, 1974, from indirect source review.

One tangential issue which has been raised frequently relates to phased construction within a single indirect source subject to review under the regulation. For example, assume that a shopping center with a 3,000-space parking area is to have four major "anchor" department stores in addition to dozens of smaller retail and service establishments. The plan is to build the bulk of the shopping center initially, including all of the parking area, but for business reasons to withhold construction of two of the "anchor" stores for two or three years after the center first opens. The two questions which arise are: (1) If construction commences on the intial part of the center prior to 1975 will the subsequent construction of the two anchors trigger-review for such two new stores? (2) Alternatively, will such subsequent construction mean that construction of the entire center is covered under the regulation under the theory that the construction which was commenced prior to 1975 was not "continuous"?

(1) The mere fact that two new stores are being added to the shopping center will not trigger indirect source review. The new construction is a modification to an existing indirect source (the shopping center with two "anchors" and 3,000 parking spaces), but modifications are not reviewed unless parking capacity is increased by 500 cars or more (1,000 cars or more in non-SMSA's). (2) The fact that the shopping center is not modified for two or three years after initial opening for business does not make the construction which commenced prior to 1975 non-"continuous" and therefore subject the entire project to indirect source review, because in essence a single indirect source (the shopping center with 3,000 parking spaces minus two anchors) was constructed in a continuous process which commenced prior to 1975.

Several persons questioned whether demolition is to be considered as "site clearance" as that term is used in the definitions of the phrases "to commence construction" and "to commence modification" in paragraph (b)(1)(v) and (vi). The Administrator considers demolition to be a form of site clearance. It is important to note, however, that the term "continuous" is crucial in the definition of these phrases. Demolition prior to 1975 will serve to exempt a project only where it is part of a continuous program of construction specifically designed for a particular indirect source. For example, where a developer demolished a structure on a particular site in 1973, then does no further physical site work until 1975, a source constructed on that site will not be exempt from review merely because the site clearance began in 1973.

Two points should be made regarding the "force majeure" (acts of God, strikes, etc.) language in paragraph (b)(1)(v). (1) The fact that construction failed to commence at all prior to 1975 because of "force majeure" reasons is irrelevant. Actual physical site work must commence in a continuous course before 1975 for the exemption to be valid. (2) Only breaks in construction attributable solely to the enumerated "force majeure" reasons will be considered in determining whether a project is exempt. For instance, if a site were demolished in 1973, then for business or other reasons, actual physical construction ceased, and a developer planned to commence continuous construction on the site in mid-1974 but was prevented from doing so until 1975 because of litigation, the source would not be exempted from review since factors other than the "force majeure" reasons played a role in rendering the construction noncontinuous.

Some comments urged that the basic coverage requirement set forth in paragraphs (b)(2)(i) and (ii) be amended to require that only those indirect sources for which a new associated parking area is constructed be subject to review. As the regulation is now written, an indirect source constructed on a presently existing associated parking area is subject to review as well.

Such an amendment would create unwarranted exemptions. One case would be that of a developer who has operated a large surface parking lot for several years, and then decides to construct an office building on part of the lot while retaining the remainder to serve as the parking lot for the building. Although the associated parking area would not be new, the office building should clearly be required to undergo pre-construction review as a new indirect source. Another example is the demolition of a large shopping center structure followed by the construction of a new shopping center on the same parcel of land using the same parking lot. In each case, it is reasonable to expect the developer to take air quality considerations into account in planning his basic design, and the construction will not be exempt from indirect source review.

A closely related matter which has drawn several questions is the status under the regulation of accidental destruction of an indirect source followed by new construction on the same parcel. Consistent with the foregoing line of reasoning, such construction would not be exempt from review. Again, the developer can fairly be expected to consider air quality in designing and planning for his new construction. New construction following destruction on a parcel would certainly be subject to more rigid building code requirements or zoning ordinances which had been enacted since the construction of the original improvements, and there is no reason to depart from this principle where a public health regulation is concerned.

Some have questioned whether a reviewing agency could use paragraph (b)

(10) to specify that an approved indirect source may be further modified without review by adding more parking spaces than the number which triggers review under paragraphs (b)(2)(i)(*b*) and (b)(2)(ii)(*b*). As discussed on February 25 (39 FR 7276), the intent of this provision is to allow a reviewing agency to reduce the number of new parking spaces that would trigger review for a particular indirect source if it is determined that such a minor modification could cause a violation of the national standards. Since it is difficult to accurately predict the extent which the area surrounding a proposed facility will grow between the approval of its initial application and any possible modification, the Administrator does not consider it appropriate to allow paragraph (b)(10) to be used to liberalize the requirements of paragraphs (b)(2)(i)(*b*) and (b)(2)(ii)(*b*). Paragraph (b)(10) has been modified to clarify this point.

Several persons have questioned whether an indirect source approval is transferable. The Administrator considers such approvals to be fully transferable between successive owners of the property for which an approval is granted so long as the indirect source is constructed and/or modified fully in accordance with the approved application and all conditions thereto.

As alluded to before, it is not possible to issue an interpretative ruling which will answer precisely every question that will arise in administering this regulation. Many questions concerning whether or not a facility is subject to review under the regulation will necessarily have to be answered on a case-by-case basis, with those administering the regulation using their sound discretion. In general, developers should assume that devices used in an attempt to evade review will be scrutinized carefully to determine whether a source actually subject to the regulation is commencing construction without the required approval. Those conducting review under the regulation should resolve doubts and close cases in favor of coverage since the purpose of the regulation is to review all new and modified indirect sources except those clearly and specifically exempted. This approach best serves the dictates of the Clean Air Act, which requires measures to "insure" the attainment and maintenance of the ambient standards.

The Administrator does not expect many evasion problems to arise in view of the significant risks developers and lenders would be taking. In commencing construction of a facility subject to the regulation without securing the necessary approval, the developer would be subject to the heavy criminal penalties of section 113 of the Clean Air Act. Moreover, further construction of the facility could be enjoined and a facility for which construction had been completed could be shut down. Thus it is doubtful whether prudent lenders will fund projects unless they are sure that a facility has either received indirect source approval or that none is needed.

In this regard, developers who plan to construct projects which they feel are exempt but which may be arguably subject to the regulation may apply for a determination of applicability ruling from EPA to achieve a greater degree of certainty in proceeding with their projects.

Such rulings should be requested in writing from the appropriate regional offices. Requests should fully recite the facts upon which the developer believes an exemption is based. In appropriate cases a ruling will be issued which will be carefully and strictly limited to the facts as understood by the agency. If construction commences in circumstances under which any material fact is at variance with those represented in the ruling request, or if a material fact were omitted from the request, then the ruling would be rendered inoperative. Applicants should be aware of section 113(c)(2) of the Clean Air Act, which provides that any person who knowingly falsifies information in any application required pursuant to the Act is subject to fine and/or imprisonment.

SPECIFIC CHANGES TO THE REGULATION

The following changes have been made as a result of public comment on the February 25, 1974, regulations.

1. *Phased development*. Paragraph (b)(2)(iv), which is intended to prevent circumvention of the regulation through numerous minor modifications, is amended below to allow each phase of a project to be constructed without the issuance of a separate permit as long as the entire project had received approval at the outset. In addition, the information to be submitted in support of an application [Paragraph (b)(3)] has been clarified with respect to phased development projects. The traffic conditions at the time each phase becomes operational must be submitted so that the Administrator can determine the project's air quality impact at any time during the development process. This determination is necessary since a facility might be acceptable upon completion at some extended future date (due to the effects of the Federal Motor Vehicle Control Program), yet could cause a violation of air quality standards at some intermediate stage of development.

2. *Basis for disapproval for violations of the carbon monoxide standard*. The Federal indirect source regulation has been promulgated to conform to the requirements of 40 CFR 51.18, which requires all state implementation plans to have indirect source review procedures to prevent construction which "will interfere with attainment or maintenance" of ambient standards. The Federal regulations proposed on October 30, 1973, provided that construction must be prevented where the indirect source would "prevent or interfere with the attainment or maintenance" of ambient standards. (Proposed 40 CFR 52.22(b)(4)(i)(*b*), 38 FR 29896.) Because some comments in response to the October 30 proposal reflected concern as to the precise meaning of the quoted phrase, the Administrator endeavored to state the test with more specificity in the final regulation (40 CFR 52.22(b)(4)(i)(*b*)–(*c*), 39 FR 7277).

Upon further analysis and consideration of comments, the Administrator has determined that the test for carbon monoxide violations can be stated more simply than in the February regulation and more in conformity with the requirements of the Clean Air Act and 40 CFR 51.18. Moreover, the new statement of the test more closely follows the intent of the October 30 proposal.

The new statement of the test requires disapproval of a facility which would either cause a new violation or exacerbate any existing violation of a carbon monoxide standard, in any portion of any air quality control region. The test as stated in the February regulation could have permitted temporary new violations of the carbon monoxide standard to be created until the specified attainment date. This would be inconsistent with the requirements of the Clean Air Act, which requires attainment of primary ambient standards "as expeditiously as practicable," not merely by the statutory deadline. To allow violations to be created or exacerbated by the construction of a new source is consistent neither with this mandate nor with 40 CFR 51.18, since to allow a new source to create new violations would "interfere" with the attainment of the standards as expeditiously as practicable.

3. *Basis for decisions involving photochemical oxidant and nitrogen dioxide*. On several previous occasions (38 FR 29893 at 29894 and 39 FR 7270 at 7272), the Administrator has expressed reservations concerning the adequacy of available analytical techniques to accurately analyze the impact of a specific indirect source on ambient air quality concentrations of photochemical oxidant and nitrogen dioxide. The application of the proportional modeling technique specified in the February 25 regulations becomes quite subjective when applied to the incremental air quality impact of a single facility or project. Since the proportional model assumes that air quality is proportional to emissions, the key to analyzing the air quality impact of a highway or airport focuses on the definition of baseline emissions. If the baseline emissions are those presently emitted on the proposed site, the predicted air quality increase would be extremely large. If the baseline emissions are those of the entire region, the predicted air quality increase would in most cases, be quite small. As a result of these problems, the Administrator has chosen to eliminate the exclusive use of the proportional model, and to base decisions involving oxidant and nitrogen dioxide on considerations to be published shortly as a new Appendix to Part 52. While the Administrator does not desire to base photochemical oxidant and nitrogen dioxide decisions exclusively on the proportional model on a national scale, states are not precluded from using such a model where they feel it is appropriate for their local needs and conditions.

4. *Use of traffic flow characteristics for highway decisions*. As promulgated on February 25. the regulations specified the use of a diffusion model for analyzing the impact of highways on carbon monoxide air quality. In developing the traffic flow characteristics discussed below, it became apparent that such criteria would be equally applicable for analyzing localized carbon monoxide concentrations in the vicinity of roads and highway. Thus, the regulations are modified below to permit the use of such characteristics, with the option of using a diffusion model if either the applicant or the Administrator deems appropriate.

5. *Applicant's opportunity to respond to public comment*. The regulations are amended to permit the applicant to respond in writing, within 10 days after the close of the public comment period, on the comments submitted by the public. The Administrator is required to consider such response in making his final decision.

6. *Permit conditions and penalties*. One comment indicated that the requirement to "operate in accordance with the application" in paragraph (b)(11) was unreasonable, since it could be construed to require the applicant to obtain permission before changing store hours or other minor operating practices which may have been indicated in the application. It was not the Administrator's intent to provide that any minor operational factor which could have no reasonable impact upon air quality be an enforceable permit condition. Accordingly, the above-quoted phase has been omitted from paragraph (b)(11). On the other hand, in most cases there will be certain operational factors which will be crucial to the air quality impact of an indirect source. Accordingly, paragraph (b)(9) is amended to permit the reviewing agency to specify that such operating provisions will be enforceable permit conditions.

It is crucial to the effective operation of the indirect source program that the reviewing agency utilize the provisions of paragraph (b)(9) to specify any such operating factor which could affect air quality as a permit condition. Conditions which must be considered on a routine basis will be:

a. A requirement that the facility, or any incremental development phase, not be opened for business prior to the date specified by the reviewing agency. Because of the continuing emission reduction effected by the Federal Motor Vehicle Control Program, the vehicle mix on the date of expected opening (and resulting average vehicle emission rate) could be an important factor in determining whether air quality standards would be violated.

b. Specification of the type and degree of modification to the approved facility that must be subject to review. Since the regulation only requires review of modifications that result in addition of a specified number of parking spaces, the reviewing agency may also specify that certain structural or use changes which would adversely impact air quality shall also be subject to review.

7. *Invalidation of approval*. Numerous comments were received indicating that in many cases, on-site construction would not commence within 18 months after receipt of approval as required under subparagraph (12). Accordingly, this period has been extended from 18 to 24 months. Subparagraph (12) still contains a provision allowing the Administrator to extend this time period upon a satisfactory showing that an extension is justified. Since the regulation has been modified to permit the applicant to request an extension at the time of initial application, this subparagraph should not introduce uncertainty for developers acting in good faith.

8. *Data to be submitted by the applicant*. Paragraph (b)(3) is amended to eliminate the requirement that an applicant submit the intermediate information, such as trip inducement and existing volumes, that are used to estimate future traffic volumes. As amended, paragraph (b)(10) requires submission of only that data needed to determine the traffic flow characteristics on which the Administrator will base his decision with respect to localized carbon monoxide concentrations. An additional parameter, vehicle capacity of major roads and intersection in the vicinity of the indirect source, is included since it is needed for determinations based upon traffic flow characteristic guidelines. Pursuant to paragraph (b)(3)(i)(i), the Administrator may request any additional information needed to check the accuracy of the estimates submitted by the applicant.

9. *Examples of traffic flow characteristics*. As indicated below, the Administrator is issuing guidelines setting forth traffic flow characteristics which may be used in determining localized carbon monoxide concentration. Consequently, the examples of traffic flow characteristics previously listed in paragraph (b)(4)(ii) are no longer necessary and have been deleted.

10. *Necessity for "on-site construction"*. In order to clear up confusion, the phrase "on-site" has been added to the definitions of "to commence construction" and "to commence modification." This is entirely consistent with the Administrator's intent as reflected in the February 25 preamble at 39 FR 7273.

11. *Sources Subject to "Management of Parking Supply" Regulations*. "Management of parking supply" regulations have been promulgated by EPA as part of the transportation control plans in 19 regions. In order to eliminate confusion as to whether the indirect source regulation is applicable to a particular facility in areas where both regulations appear to be in effect, the indirect source regulation has been amended to state that in such areas, sources which would otherwise be required to undergo review under both regulations will be subject to review only under the management of parking supply regulation. Thus, applicants will not be required to apply for permits from EPA through two separate procedures. The parking management regulations will require facilities of the size subject to indirect source review to undergo carbon monoxide impact analysis similar to that required by the indirect source regulation in addition to other parking management review requirements.

It should be noted, however, that the parking management regulations will not exempt from review sources of the size covered by the indirect source regulation merely because a general construction contract had been executed for such a source. Such sources shall be exempt only if they have commenced on-site construction or modification on or before January 1, 1975. The management of parking supply regulations will soon be refined by EPA in the respects noted above.

12. *Basis for Decisions on Carbon Monoxide Impact*. Paragraph (b)(4)(ii) has been clarified to emphasize that there are a number of analytical techniques which may be acceptable for evaluating the concentration of carbon monoxide in the vicinity of indirect sources. As discussed below, the Administrator has developed and published traffic flow characteristic guidelines which will be one method which may be used. The use of such guidelines, however, is not a requirement of the regulation.

As explained in the preamble to the February promulgation at 39 FR 7275, these guidelines will have the beneficial effect of allowing developers to plan their facilities so as to maximize their chances for approval. Such guidelines will frequently be used by EPA in conducting review since they provide a rather simple and expeditious method in analyzing carbon monoxide impact. Nevertheless, it is expected that in many cases other methods, such as diffusion modeling, will have to be relied on in making the determination. For instance, where basic technical assumptions used in developing the guidelines are not appropriate in a certain area, the guidelines would not be used as the basis for deciding whether a permit may be granted. Instead, a diffusion model or other technique which more accurately takes account of the actual conditions at a particular site would have to be used.

13. *Minor clarification changes*. There have been several other minor drafting changes made for clarification purposes which do not change the scope or intent of the regulation.

ANALYTICAL TECHNIQUES FOR DETERMINING CARBON MONOXIDE CONCENTRATIONS

In the preamble to the February 25 promulgation, the Administrator indicated that he would publish guidelines setting forth traffic flow characteristics which may be used in analyzing the carbon monoxide impact of indirect sources. Accordingly, the Agency is publishing Guidelines for the Review of the Impact of Indirect Sources on Ambient Air Quality which specify the analytical techniques the Agency will frequently use in determining the air quality impact of an indirect source on localized carbon monoxide concentrations. (See discussion under #12 above.)

These guidelines will be available for inspection and distribution at each Regional Office as well as the EPA Freedom of Information Center, 401 M Street, S.W., Washington, D.C. 20460. As is true of any guidelines setting forth the Agency's procedures or practices, EPA welcomes any relevant written comments relating to these guidelines at any time. Interested persons may submit written comments to the Monitoring and Data Analysis Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711.

The main bodv of the Guidelines contains a simplified methodology which relates certain key traffic flow characteristics to local carbon monoxide concentrations. Nine appendices are also included for conducting a more complete analysis, if necessary, of the impact of an indirect source on ambient air quality. Seven of the appendices discuss methods for estimating emissions from the different types of indirect sources, the eighth discusses the use of dispersion models which may be used in such an analysis as well as methods for estimating background concentrations, and the ninth appendix provides a compilation of indirect source monitoring studies. The Guidelines also include a discussion of several considerations for improving traffic flow characteristics, thus minimizing a facility's potential to contribute to a violation of the national standards for carbon monoxide.

ADMINISTRATIVE PROCEDURES AND DELEGATION

Where the Administrator has not delegated the responsibility for implementing § 52.22(b) for indirect source review to a State or local agency, the implementation of the regulation will be the responsibility of the appropriate EPA Regional Administrator. A list of the States covered by each Regional Office and the Regional Office addresses are set forth in § 52.16 of Part 52. Questions concerning the applicability of the regulation and any other inquiries should be directed to the appropriate Regional Office. Application forms should be requested from the Regional Office and returned there for review. Since forms will not be available immediately, early applicants should contact the appropriate Regional Office for interim advice concerning the format for application. Those applicants wishing to submit the results of diffusion modeling or other analytical technique in support of their application are urged to contact the Regional Office first to discuss the appropriate input parameters and receptor sites which are of critical interest.

With respect to highways and airports, it is expected that all necessary technical data will be available in an Environmental Impact Statement (EIS) prepared pursuant to the National Environmental Policy Act (42 U.S.C. 4321). In such cases, all that is necessary to make application is a letter to the appropriate Regional Administrator from the initiating agency, accompanied by the EIS if not previously submitted, requesting permission to construct. If additional data are required, the Regional Office will notify the applicant within 20 days after receipt of the request.

Normally, the draft EIS for highway projects is prepared after the general corridor has been defined but before a specific location has been selected. A draft EIS is circulated on the various location alternatives and a public hearing is held on the EIS. Depending on the comments received, the State highway agency may decide to abandon the project due to its adverse environmental consequences, re-draft the EIS to contain additional alternatives, or issue the final EIS on the alternatives considered in the draft. Following the issuance of the final EIS, the State highway agency generally proceeds with the following steps leading to the eventual construction of the highway: selects preferred alternative; performs detailed highway design and development of specifications; holds design hearing; obtains approval and funding commitment from the Federal Highway Administration; acquires right-of-way land and appropriate easements; advertises for and analyzes bids; and awards construction contracts.

The application for approval under the indirect source regulations would normally be made as early in the above process as the necessary data are available, which would not be earlier than the location study phase. The highway agency may, of course, make application at any later phase prior to actual commencement of construction. Although the Administrator would prefer to consider only the selected alternative based on the final EIS, he will provide the highway agency with a decision on each of the alternatives specifically analysed in the draft EIS. In addition, review based on the draft EIS coincides with EPA's present procedures for review and rating of EIS's. Although not required, the Administrator urges States or local agencies accepting delegation of these regulations to utilize administrative procedures similar to those outlined above.

The Administrator reiterates his desire to delegate the indirect source review procedures to States and/or local governments. States will soon be receiving communications from EPA's regional offices containing more details regarding delegation.

If a State agency has not officially requested delegation, the Administrator will entertain requests from local agencies. Local agencies may inquire about delegation procedures at the appropriate EPA Regional Offices. However, no delegation will be made directly to a local agency if a State agency has already received delegation. In addition to the guidance provided on February 25, 1974, as to what type of agency should receive delegation, the Administrator feels there are certain agencies which should not be delegated review responsibility where a conflict of interest could be created. For example, the Administrator will not delegate the indirect source review to agencies, such as State highway agencies, which are substantially responsible for originating projects subject to review under these regulations.

Since the amendments being published today are in response to public comments based upon the regulation published in February and review is to begin under the regulation immediately, the Administrator finds good cause not to subject the amendments to further public comment before finalization as such procedure would be unnecessary and impracticable. Appendix A is being promulgated in final form because interpretative rulings are exempt from the notice and public comment requirements of the Administrative Procedure Act. For the convenience of applicants, reviewing officials, and all other interested persons, the regulation is being reprinted in its entirety in its amended form. (Sections 110(a)(2)(B), 110(c), and 301(a) of the Clean Air Act, as amended (42 U.S.C. 1857c-5(a)(2)(B), 1857c-5(c), and 1857g(a)).)

Dated: June 28, 1974.

JOHN QUARLES,
Acting Administrator.

Appendix C – Proposed Clean Air Act Amendment for Transportation Control Plans

Sec. 3. Section 110 of the Clean Air Act is amended by adding subsection (g) as follows:

"(g) (1) Upon application by the Governor of a State on or after June 1, 1976, the Administrator may extend for not more than five years the deadline for attainment of national primary ambient air quality standards where transportation control measures are necessary for the attainment of such standards, and where the implementation of such control measures would have serious adverse social or economic effects.

(1) The Administrator may consider extension applications for only those air quality control regions in which the State has:

(A) implemented or will have begun implementing by June 1, 1977, the requirements of the applicable plan with respect to stationary source emissions of transportation-related pollutants and all reasonably available measures of the applicable transportation control plan.

(B) completed a detailed planning study that evidences public and local governmental involvement and includes examination of alternative measures and combinations of measures which could be used to attain and maintain the standards after June 1, 1977, a description of projects to be undertaken together with timetables and resource requirements, and identification and analysis of social, economic, and environmental effects including public health effects of such measures and projects.

(3) Each extension application shall be accompanied by adequate documentation of compliance with the requirements of paragraph (2) above, and shall include an implementation plan for the extension period requested. The plan shall:

(A) identify the remaining emission reductions necessary for attainment of the national primary ambient air quality standards and the reasonably available measures to be implemented to accomplish these reductions;

(B) provide for the implementation of all reasonably available control measures as expeditiously as practicable;

(C) identify the financial and manpower resources to be committed to carrying out the plan;

(D) demonstrate (i) attainment of the national primary ambient air quality standards as expeditiously as practicable but no later than May 31, 1982, or (ii) that such attainment is not possible within the extension period despite implementation of all reasonable available and achievable control measures."

"(4)(A) Within 120 days following the submission of an application and all supporting materials, and after providing an opportunity for public comment, the Administrator shall grant an extension, if he determines that the requirements of this subsection have been met.

(B) If the Administrator determines that the requirements of this subsection have not been met, including findings relating to the impacts of the transportation control measures upon the social, economic and environmental welfare of the air quality control region, he shall notify the governor of deficiencies in the application, including his judgment as to acceptable dates for implementing measures included in the plan and as to the appropriate duration of an extension. The notification shall also specify a date for the submission of a revised *application.*

"(5) Where the Administrator grants an extension based on an application meeting the requirements of subparagraph (g)(3)(D)(ii), the Governor of the State may, on or after June 1, 1981, apply for a further extension in accordance with and subject to the requirements of this subsection. No extension under this paragraph may extend beyond May 31, 1987."

"(6) Where the Administrator denies an extension application or where the Governor of a State in which the national primary ambient air quality standards are not being met does not submit an application under this subsection, the Administrator may, after consultation with appropriate State and local elected officials, propose and promulgate an implementation plan (or portion thereof) meeting the requirements of this subsection."

"(7) No transportation control measures which would have serious adverse social or economic effects shall be considered "reasonably available."

☆ U. S. GOVERNMENT PRINTING OFFICE: 1975–626-955/274 3-I